Pacific Commercial Fishery Updates For Invertebrate Resources (2000)

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ABSTRACT

Harbo, R. M. and Wylie, E. S. (eds.) 2006. Pacific commercial fishery updates for invertebrate resources (2000). Can. Manuscr. Rep. Fish. Aquat. Sci. 2735: viii + 304 p.

Fishery updates present catch and effort data and identify issues in the many invertebrate fisheries on the Pacific coast of Canada. These papers often form the basis for requests for stock assessment advice.

There are more than 30 species of invertebrates exploited commercially and in 2000 the reported landings were 23,159 tonnes, a slight reduction from 1999, primarily due to quota reductions in the red sea urchin fishery. The landed value of invertebrates increased from 1999 to approximately $128 million.

The report has been organised by sections on molluscs, echinoderms and crustaceans. Specific gear types are identified in each section.

RÉSUMÉ

Harbo, R. M. and Wylie, E. S. (eds.) 2006. Pacific commercial fishery updates for invertebrate resources (2000). Can. Manuscr. Rep. Fish. Aquat. Sci. 2735: viii + 304 p.

Les mises à jour donnent les données de capture et d'effort de pêche et identifient les problèmes rencontrés dans les diverses pêches aux poissons invertébrés de la côte canadienne du Pacifique. Ces documents constituent souvent la base des demandes d'avis en matière d'évaluation des stocks.

On compte plus de trente espèces d'invertébrés exploitées commercialement. En 2000, les débarquements ont représenté 23 159 tonnes de poisson, soit une légère diminution par rapport aux années précédentes en raison principalement des réductions de quotas dans les pêches d'oursins rouges. La valeur des débarquements d'invertébrés a enregistré une hausse, et représente environ 128 millions de dollars.

Ce rapport se présente en plusieurs sections concernant les mollusques, les énchinodermes et les crustacés. Les engins spécifiques utilisés sont indentifiés dans chaque section.

1.0. INTRODUCTION

This is one of a series of documents reporting on the fisheries and stock status of invertebrate resources on the Pacific coast of Canada. Earlier reports include Bernard (1982), Jamieson (1985), Jamieson and Francis (1986), Harbo and Jamieson (1987), Thomas (1990; 1992), and Harbo and Hobbs (1997).

Since 1986 there have been annual summaries of invertebrate fisheries published in the annual reports of the Pacific Stock Assessment Review Committee (PSARC). These reports can be found at: http://www.dfo-mpo.gc.ca/csas/Csas/English/Publications/Stock_Report_e.htm

This manuscript presents fishery data summaries and preliminary analyses of catch and effort data from fish slips and harvest logs.

Fishery updates are presented to the invertebrate PSARC subcommittee annually in the fall. Scientific advice is developed through PSARC and meetings of the regional DFO shellfish working group and regional advisory committees with client representatives.

The fishery updates in this document are organised by species groups rather than fishery gear types.

1.1. Invertebrate Species Exploited

There are three major groups of invertebrates harvested; molluscs, crustaceans and echinoderms. A list of common names and scientific names are presented in Table 1.1, as well as licence categories, gear types and numbers of licences issued in 2000.

All fisheries for northern abalone (*Haliotis kamtschatkana*), were closed in December 1990, pending further stock assessments and signs of recovering and rebuilding stocks.

1.2. Landings and Landed Values

The landings and landed values of invertebrate fisheries resources are in Tables 1.2, 1.3, 1.4, and 1.5.

1.3. Pacific Fishery Management Areas

The Pacific Fishery Management Areas are shown for the British Columbia in Figure 1.1. The Fisheries Management Sector is divided into three divisions for marine fisheries: the North Coast Division (Areas 1 to 10), South Coast Division (Areas 11 to 27), and the Fraser River Division (Areas 28 and 29). Invertebrate resources in offshore areas are managed by the adjoining inshore divisions.

1.4. Management Framework for Invertebrate Fisheries

A brief description of fishery management framework by species is shown in Table 1.6.

1.5. Common Biological Objectives

There are objectives for all fisheries. These objectives are to understand oceans and aquatic resources, to manage and protect the fisheries resource, to maintain and protect the marine and freshwater environment, to maintain maritime safety, and to facilitate maritime trade, commerce and ocean development.

The Biological Objective Working Group of the Pacific Stock Assessment Review Committee identified three biological objectives for management of Pacific Region fish and invertebrate stocks (Rice *et al.* 1995). They are:

1. Ensure that subpopulations over as broad a geographical and ecological range as possible do not become biologically threatened (in the COSEWIC sense of "threatened").
2. Operationally, Objective 1 requires at least that management allow enough spawners to survive, after accounting for all sources of mortality (including all fisheries and natural mortality), to ensure production of enough progeny that they will be able to replace themselves when mature.
3. Fisheries may have collateral effects on other species, mediated by the ecological relationships of the target species. Fisheries should be managed in ways that do not violate the above objectives for ecologically related species, as well as target species.

1.6. Fishery Management Objectives

General management goals and objectives are common to all shellfish fisheries described in the annual management plans produced by the Department. The objectives are:

- To ensure conservation and protection of invertebrate stocks and their habitat through the application of scientific management principles applied in a risk averse and precautionary manner based on the best scientific advice available.
- To meet the federal Crown's obligations regarding Aboriginal fisheries for food, social and ceremonial purposes.
- To develop sustainable fisheries through partnership and co-management arrangements with client groups and stakeholders to share in decision making, responsibilities, costs and benefits.
- To develop fishing plans and co-operative research programs which will contribute to improving the knowledge base and understanding of the resource.
- To consider the goals of stakeholders with respect to social, cultural and economic value of the fishery.
- To consider health and safety in the development and implementation of management plans, fishery openings and closures.
- To consider opportunity for the development of the aquaculture industry.
- To provide opportunities for recreational fisheries.

Table 1.1. List of common and scientific names of commercially exploited species of invertebrates in British Columbia in 2000.

Phylum - Class common name	Scientific name	Gear Type	Licence Category	# of eligible Licences[1]	Comments
PHYLUM MOLLUSCA					
CLASS BIVALVIA					
geoduck (king clam)	*Panopea abrupta*	dive	G	55	
horse clam (gaper clam)	*Tresus capax, Tresus nutallii*	dive /	G	55	
manila clam	*Tapes philippinarum*	intertidal	Z2	1144	
littleneck (native) clam	*Protothaca staminea*	intertidal	Z2	1144	
butter clam	*Saxidomus gigantea*	intertidal	Z2	1144	
razor clam	*Siliqua patula*	intertidal		6 [2]	[2] See footnote
pink (smooth, swimming)	*Chlamys rubida*	dive / net	XZI, XZR	12	Experimental
spiny (pink, swimming)	*Chlamys hastata*	dive / net	XZI, XZR	12	Experimental
CLASS CEPHALOPODA					
Pacific octopus	*Octopus dofleini*	dive / trap	XZG	18	Experimental
opal squid	*Loligo opalescens*	net	ZE	55	Not limited entry
PHYLUM ARTHROPODA					
CLASS CRUSTACEA					
SUBCLASS MALACOSTRACA					
euphausiids (krill)	*Euphausia pacifica*	net	ZF	18	
prawn (spot shrimp)	*Pandalus platyceros*	trap	W	253	
smooth pink shrimp	*Pandalus jordani*	trap / net	W,S	W-253, S-246	
northern (spiny) pink shrimp	*Pandalus borealis*	trap / net	W,S	W-253, S-246	
flexed pink shrimp	*Pandalus goniurus*	trap / net	W,S	W-253, S-247	
sidestripe shrimp	*Pandalopsis dispar*	trap / net	W,S	W-253, S-246	
coonstripe shrimp	*Pandalus danae*	trap / net	W,S	W-253, S-246	
humpback shrimp	*Pandalus hypsinotus*	trap / net	W,S	W-253, S-246	
Dungeness crab	*Cancer magister*	trap	R	221	
red rock crab	*Cancer productus*	trap	R	221	
red (Alaska) king crab	*Paralithodes camtschatica*	trap	R	221	
golden (brown) king crab	*Lithodes aequispina*	trap	R	221	

Table 1.1. continued

Phylum - Class common name	Scientific name	Gear Type	Licence Category	# of Eligible Licences[1]	Comments
SUBCLASS CIRRIPEDIA					
gooseneck barnacles	*Pollicipes polymerus*	intertidal			Experimental
PHYLUM ECHINODERMATA					
CLASS ECHINOIDEA					
red sea urchin	*Strongylocentrotus franciscanus*	dive	ZC	110	
green sea urchin	*Strongylocentrotus droebachiensis*	dive	ZA	49	
CLASS HOLOTHURIODEA					
California sea cucumber	*Parastichopus californicus*	dive	ZD	85	

[1] - number of eligible commercial fishing licences in 2000

[2] - 6 non-native fishermen were eligible for licences, the other fishermen were designated from a communal commercial licence held by the Council of the Haida Nation (CHN).

Table 1.2. Landings of invertebrates (tonnes) in commercial fisheries in B.C., 1981 to 1991.

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
INTERTIDAL CLAMS [1] - Commercial Fishery:											
Razor	30	68	31	100	90	142	142	155	117	114	117
Butter	120	103	77	130	251	158	68	134	92	109	42
Manila	317	597	1,048	1,677	1,913	1,893	3,607	3,909	2,764	1,456	982
Nat. Ln.	179	241	324	294	191	284	373	290	433	465	201
Mixed	161	155	279	410	477	371	87	27	159	339	137
SubTotal: Commercial Fishery	807	1,164	1,759	2,611	2,922	2,848	4,277	4,515	3,565	2,483	1,479
FARMED CLAMS					4	7	25	30	31	39	169
TOTAL INTERTIDAL CLAMS	**807**	**1,164**	**1,759**	**2,611**	**2,926**	**2,855**	**4,302**	**4,545**	**3,596**	**2,522**	**1,648**
GEODUCK	2,704	3,135	2,636	3,483	5,370	5,006	5,734	4,567	3,985	3,956	3,333
HORSE CLAM	51	321	21	7	6	96	355	325	115	124	110
SHRIMP	581	413	411	408	678	768	2,644	2,561	2,299	1,940	3,265
PRAWN	358	274	331	505	514	550	620	720	820	761	961
CRAB [2]	1,317	1,003	960	1,155	1,165	1,321	1,631	1,508	1,522	2,168	1,887
ABALONE	85	82	56	58	42	52	49	49	49	50	closed
OCTOPUS		18	30	25	32	53	129	209	217	198	131
SEA URCHIN	116	160	986	1,764	1,815	2,067	2,223				
RED								2,116	2,658	3,158	6,945
GREEN								444	609	475	607
SEA CUCUMBER [3]				113	346	786	1,722	1,922	1,144	870	1,340
SCALLOP		8	11	18	53	68	66	67	75	69	82
PLANKTON	19		47	103	131	166	130	247	360	530	450
SQUID		29	15	69	111	79	86	88	70	72	116
MUSSELS			tr	1	tr	2	2	3	4	1	tr
GOOSENECK BARNACLES					tr	2	32	49	30	37	40
OYSTERS - Farmed		1,579	2,453	2,897	3,420	2,864	3,482	3,702	3,721	4,547	4,482
TOTAL TONNES	**6,038**	**8,186**	**9,716**	**13,217**	**16,609**	**16,735**	**23,207**	**23,122**	**21,274**	**21,478**	**25,397**

[1] the sum of commercial fishery landings, depurated and Aboriginal licenced harvest, and not including production from clam tenures

[2] crab landings include tanner, king, other and dungeness crabs (1989 to 1991)

[3] landings are round weight

Table 1.3. Landings of invertebrates (tonnes) in commercial fisheries in B.C., 1992 to 2000.

Year	1992	1993	1994	1995	1996	1997	1998*	1999*	2000*
INTERTIDAL CLAMS [1] - Commercial Fishery:									
Razor	55	44	105	131	75	109	40	78	237
Butter	132	102	174	101	100	145	40	116	96
Manila	914	1,059	1,376	1,292	1,161	881	1,105	1,216	898
Nat. Ln.	116	131	94	140	56	60	50	96	156
Mixed	124	133	87	3	112	112	119	110	78
SubTotal: Commercial Fishery	1,341	1,469	1,836	1,667	1,504	1,306	1,354	1,616	1,465
FARMED CLAMS	300	300	500	885	985	755	700	900	1,000
TOTAL INTERTIDAL CLAMS	**1,641**	**1,769**	**2,336**	**2,552**	**2,489**	**2,061**	**2,054**	**2,516**	**2,465**
GEODUCK	2,864	2,455	2,235	**2,098**	**1,842**	**1,796**	**1,797**	**1,797**	**1,797**
HORSE CLAM	2	23	62	1	-	7	1	5	13
SHRIMP [2]	2,683	3,283	3,192	7,257	7,386	2,852	3,493	2,646	2,352
PRAWN 6	1,168	1,215	1,309	1,300	1,759	1,800	1,699	1,439	1,748
CRAB [3]	3,355	6,306	6,002	4,747	5,025	3,923	2,972	2,937	2,704
ABALONE	closed	closed	closed	closed	closed	closed	closed	closed	closed
OCTOPUS	117	145	89	95	197	207	138	46	47
SEA URCHIN [4]									
RED	12,018	6,388	5,829	**6,807**	**6,272**	**8,727**	**5,187**	**5,283**	**4,815**
GREEN	1,042	714	332	**157**	**150**	**160**	**156**	**187**	**181**
SEA CUCUMBER (round wt.)	1,242	812	556	593	**657**	**628**	**754**	**953**	**1,014**
SCALLOP	91	90	104	96	109	73	59	39	53
PLANKTON	380	53	333	562	507	**382**	**491**	**460**	**504**
SQUID	93	13	175	76	78	#	22	#	#
MUSSELS	-	-	-	-	-	-	-	-	-
GOOSENECK BARNACLES 5	38	30	28	7	14	10	4	3	1
OYSTERS - Farmed	4,500	4,000	4,900	5,300	5,437	4,900	5,500	5,600	5,500
TOTAL TONNES	**31,234**	**27,296**	**27,482**	**31,648**	**31,922**	**27,531**	**24,328**	**23,918**	**23,195**

*preliminary landings for non-validated fisheries for 1999 and 2000.

[1] the sum of commercial fishery landings, depurated and Aboriginal licenced harvest, and not including production from clam tenures

[2] The Shrimp fishing year changed in '97. Catch for '97 includes data from Jan 97 to Mar 98.

The following years contain data from April of the column year to March of the next year.

[3] crab landings include tanner, king, other and dungeness crabs.

[4] red and green sea urchin landings from 1995 to 1999 taken from validation logs

- the green urchin fishing season changed in '95 so the totals include catch from June of the column year to May of the following year (1995 totals are for 1.5 years).
- the red urchin fishing season changed in '97 so the totals include catch from July of the column year to June of the following year (1997 totals are for 1.5 years).

[5] The Gooseneck Barnacle fishery closed in Spring of 1999.

[6] Prawn Landings are from Logs from 2000 onward

# Data is confidential, less than 3 vessels fished.

Table 1.4. Landed value of invertebrates in thousands of dollars in British Columbia, 1981-1991.

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
INTERTIDAL CLAMS[1] - **Commercial Fishery:**											
Razor	24	55	24	123	95	127	126	137	124	130	129
Butter	42	36	33	55	138	75	40	63	44	53	34
Manila	323	611	1,043	1,813	2,278	2,762	6,003	7,175	6,003	3,761	2,574
Nat. Ln.	195	263	329	311	202	327	474	359	588	710	327
Mixed	175	169	293	455	575	510	132	36	196	625	238
SubTotal: Commercial Fishery:	759	1,134	1,722	2,757	3,288	3,801	6,775	7,770	6,955	5,279	3,302
Farmed Clams:					4	14	43	59	96	140	556
TOTAL INTERTIDAL CLAMS	**759**	**1,134**	**1,722**	**2,757**	**3,292**	**3,815**	**59**	**7,829**	**7,051**	**5,419**	**3,858**
GEODUCK	2,434	2,814	1,818	2,937	4,605	4,294	6,184	9,762	12,967	10,582	9,659
HORSE CLAM	42	235	12	5	6	63	309	300	144	274	119
SHRIMP	912	644	1,073	1,022	1,180	1,240	4,609	2,802	2,985	2,637	4,430
PRAWN	2,019	1,545	2,138	3,262	3,379	3,734	4,326	5,873	7,084	7,006	7,728
CRAB[2]	3,556	2,345	3,320	4,558	4,719	5,661	6,452	5,945	6,088	9,311	8,688
ABALONE	721	696	462	530	442	734	973	1,076	1,170	1,347	closed
OCTOPUS		39	63	56	82	136	381	649	705	657	414
SEA URCHIN	34	56	358	712	763	1,011	1,276	1,825	2,651	2,901	5,982
RED								1,241	1,631	1,953	4,187
GREEN								584	1,020	948	1,795
SEA CUCUMBER				22	94	236	768	961	998	1,168	1,029
SCALLOP		17	24	56	95	212	244	285	316	317	387
PLANKTON	6	-	19	42	89	113	102	192	223	415	390
SQUID		22	21	84	184	127	132	113	94	81	148
MUSSELS		tr	tr	tr	-	tr	tr	tr	tr	1	tr
GOOSENECK BARNACLES					1	4	211	479	343	413	418
OYSTERS - Farmed		981	1,554	2,109	2,613	2,515	2,548	2,725	2,938	3,613	3,465
TOTAL VALUE ($000)	**10,483**	**10,528**	**12,584**	**18,152**	**21,544**	**23,895**	**28,574**	**40,816**	**45,757**	**46,142**	**46,715**

[1] the sum of commercial fishery landings, depurated and Aboriginal licenced harvest, and not including production from clam tenures

[2] crab landings include tanner, king, other and dungeness crabs (1989 to 1991)

Table 1.5. Landed value of invertebrates in thousands of dollars in British Columbia, 1992-2000.

Year		1992	1993	1994	1995	1996	1997	1998*	1999*	2000*
INTERTIDAL CLAMS [1]	- Commercial Fishery:									
	Razor	82	67	186	231	137	200	79	127	418
	Butter	81	60	103	71	70	103	33	104	97
	Manila	2,253	2,761	3,776	4,158	3,349	2,745	3,747	4,111	3,385
	Nat. Ln.	193	212	147	241	100	116	97	187	338
	Mixed	252	271	198	7	193	192	239	205	151
SubTotal: Commercial Fishery:		2,861	3,371	4,410	4,708	3,849	3,357	4,195	4,734	4,388
Farmed Clams:		1,000	1,200	1,900	3,885	4,455	3,369	3,600	4,700	6,600
TOTAL INTERTIDAL CLAMS		**3,861**	**4,571**	**6,310**	**8,593**	**8,304**	**6,726**	**7,795**	**9,434**	**10,988**
GEODUCK		16,237	26,994	33,426	43,284	36,221	33,264	29,801	32,797	40,642
HORSE CLAM		2	46	111	3	-	13	1	10	27
SHRIMP [2]		2,831	3,494	4,772	14,123	11,725	5,735	5,763	4,816	4,045
PRAWN		9,409	10,124	12,140	17,722	26,649	26,330	19,537	18,814	32,776
CRAB		11,203	18,761	25,686	24,058	23,548	28,565	21,479	21,770	19,465
ABALONE		closed	closed	closed	closed	closed	closed	closed	closed	closed
OCTOPUS		348	441	261	317	757	838	488	187	167
SEA URCHIN [3]		13,084	9,048	10,160	12,681	13,241	14,991	8,847	9,527	8,927
RED		8,660	5,271	8,038	11,735	12,299	13,986	7,876	8,362	7,898
GREEN		4,424	3,777	2,122	946	942	1,004	972	1,166	1,028
SEA CUCUMBER		1,363	982	976	956	688	780	986	1,140	1,748
SCALLOP		420	423	490	476	536	376	318	224	319
PLANKTON		318	41	259	357	472	334	493	447	482
SQUID		135	17	199	95	97	#	44	#	#
MUSSELS		-	-	-	-	-	-	-	-	-
GOOSENECK BARNACLES [4]		448	320	273	73	112	95	40	32	21
OYSTERS - Farmed		3,600	4,700	4,500	5,400	6289	5100	4,900	5,700	6,600
TOTAL VALUE ($000)		**63,258**	**79,962**	**99,562**	**128,138**	**128,639**	**123,156**	**100,495**	**104,913**	**126,211**

*preliminary landings for non-validated fisheries.

[1] the sum of commercial fishery landings, depurated and Aboriginal licenced harvest, and not including production from clam tenures. Values estimated for Depuration landings.

[2] The Shrimp fishing year changed in '97. Value for '97 includes data from Jan 97 to Mar 98. The following years contain data from April of the column year to March of the next year.

[4] red and green sea urchin landings from 1995 to 1999 taken from validation logs
- the green urchin fishing season changed in '95 so the totals include catch from June of the column year to May of the following year (1995 totals are for 1.5 years).
- the red urchin fishing season changed in '97 so the totals include catch from July of the column year to June of the following year (1997 totals are for 1.5 years).

[4] The Gooseneck Barnacle fishery closed in Spring of 1999.

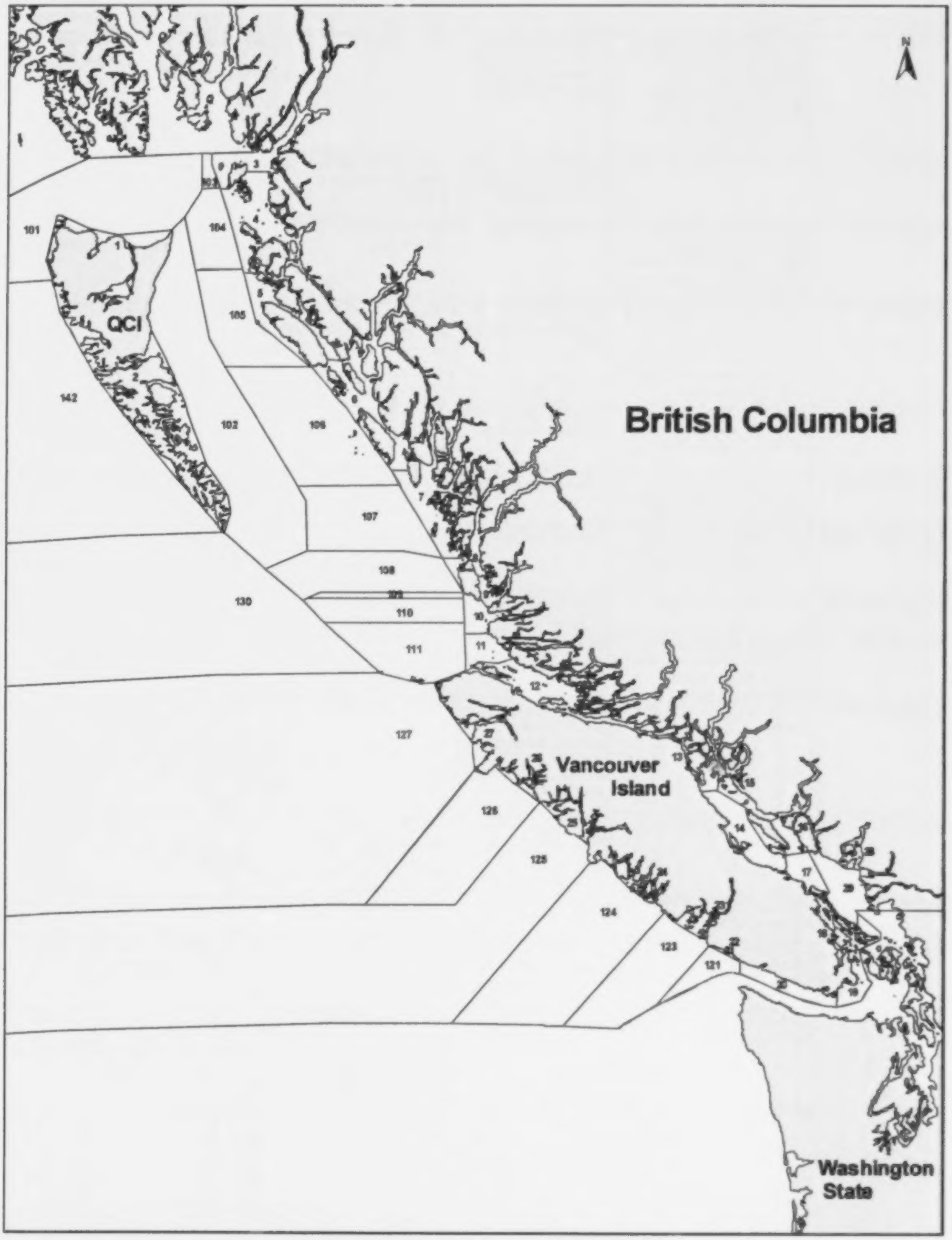
[5] Prawn Landings are from Logs from 2000 onward

# Data is confidential, less than 3 vessels fished.

Table 1.6. Management framework for invertebrate fisheries, 2000.

SPECIES	LICENCES	QUOTA	SEASONS	COMMENTS
Geoduck	Limited entry (G tab). 55 licences. Vesseal may have no more than 3 licences (stacked). Licence conditions include notification, validation and catch reporting requirements. Validation costs funded by licence holders.	2000 quota is 1796 t for IVQ's of 32.7 t (72,000 lb) Quota cannot be carried over to the following year.	Varies by area	Fishery areas are in a three year rotation. Quotas based on an annual yield of 1% of the virgin biomass.
Horse Clam	Limited to the 55 geoduck licences.	No directed fishery. Caught incidentally. Catch Ceilings: West 7t, Inside 13t.	Varies by area and only in areas open to geoduck harvesting.	No harvest in eelgrass beds. West=protions of 24 & 25. Inside=protions of 13,15,18&19.
Green Sea Urchin	Limited entry. 49 licences. Up to 3 licences can be stacked on a vessel. Licence conditions include notification, validation and catch reporting requirements.	I.Q.'s 3.84t (8,457 lb).	Nov. 10/00 to March 15/01. Area Quotas.	Handpicking by divers only. Permanent closures in marine protected areas. Minimum size limit in effect.
Red Sea Urchin	Limited entry. 110 licences. ZC tab with area selection. Up to 3 licences can be stacked on a vessel. Licence conditions include notification, validation and catch reporting requirements.	I.Q.44.4t (97,923 lb). 19 Quota's South, 91 Quota's North.	Area Quotas. Season runs from July 1/00 to June 30/01.	Minimum size limit in effect.
Gooseneck Barnacle	Commercial fishery closed and converted to experimental status. 6 scientific licences were issued.	Harvest was limited to areas that were pre-surveyed.	Open on specific tides.	Less than 10% of the stock is available for harvest due to harvest conditions or unsuitable size and quality for the available markets.
Pink and Spiny Scallop (net)	Commercial fishery closed and converted to experimental status. 2 scientific licences were issued.	None. Managed by size limit	Some permanent area closures.	South Coast Only.
Pink and Spiny Scallop (dive)	Commercial fishery closed and converted to experimental status. 12 scientific licences were issued.	None. Managed by size limit.	Some permanent area closures.	South Coast Only.
Plankton - Euphausiids	Limited entry. 18 ZF licences	Mainland inlets: 275 t. Strait of Georigia: 225t.	Nov. - Dec. Opened Aug - Oct 31 on request.	
Octopus (by Dive)	Commercial fishery closed and converted to experimental status. Licences were limited to 18 experienced harvesters.	None.	All year	Licences were area based. Harvest from shore without a vessel in not permitted.
Prawn/Shrimp by trap	Limited entry. W tab. 253 licence eligible.	Managed by time and area closures based on a minimum escapement of the spawner cohort. Minimum size limit and gear escapement regulations.	Apr 22 - July 9/00	
Shrimp Trawl	Limited entry. 248 S tab licences.	Catch ceilings by Shrimp Management Area (SMA).	All year, with in-season monitoring of shrimp counts. Area closures. No prawn retention in areas closed to prawn trap fishing.	
Squid	Not limited entry. ZE tab. 14 licence issued in 2000.	None.	Permanent area closures.	
Crab	Limited entry. R tab. 221 licences were eligible.	Managed by size limit. No quota. Area-specific trap limits. Trap escapement regulations.	Area licencing, area closure due to softshell or alocation to aboriginal or sport fisheries.	Non-retention of females. Rot panel size set for traps without hinged lids from 20 to 11 cm. Crab traps to be fitted with one escape hole at least 110 mm diameter.
Intertidal Clam	Limited entry. Z2 tab. 1144 eligible licences.	Managed by min. size limit. No Quotas.	Seasonal openings and closures, staggered opening to maintain market supply. Closure for allocation to aboriginal and sport fisheries.	Area-specific licences, licence holders choose 1 of 7 areas. 5 companies currently harvesting clams under a depuration licence.

Figure 1.1. Pacific Fishery Management Areas (PFMA).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2.0. MOLLUSCS

2.1. Geoduck Clam Fishery – S. Heizer and E. Rome

2.1.1. Introduction

The commercial dive fishery for geoducks in British Columbia began in 1976. The fishery expanded rapidly until 1979 when limited entry came into effect and harvest quotas were set for conservation. This fishery is limited to 55 "G" licences. Coast-wide landings of geoducks peaked in 1987 at 12,643,298 lbs. (5735 t), but decreased to 3,960,083 lbs. (1,796 t) in 1997, 3,960,755 lbs. (1797 t) 1998, 3,960,676 lbs. (1797 t) in 1999, 3,960,979 lbs (1797 t) in 2000 and to a projected 4,015,000 lbs. (1,821 t) in 2001, due to recent stock assessments.

In 1989, with the support of industry, a management program with equal individual licence quotas (IQs) was initiated. Licence quotas were set at 1/55 of the annual coast-wide quota and fishers were required to select one of three licence areas in which to fish. As part of this initiative, area licensing and a three-year area rotation period for the fishery was established.

Individual quotas decreased from 160,000 lbs. (72,576 kg) per licence in 1989 to 72,000 lbs. (32,659 kg) in 1997 through 2000 as a result of stock assessments and increasingly conservative management strategies. As a result of these reductions in annual quotas, there has been a shift in area selection, since 1994, with more licences assigned to the north coast areas.

Ex-vessel prices for geoducks increased from $0.49/lb. ($1.08/kg) in 1987 to $1.43/lb. ($3.15/kg) in 1989, following the introduction of the IQ program. Since 1989, the average whole landed value for geoduck continued to increase and peaked at $10.26/lb. ($22.62/kg) in 2000. The total landed value of geoduck in 2000 was $40.6 M, compared to the peak value of $43.3 M in 1994. The geoduck fishery ranks first in landed value of invertebrate fisheries in British Columbia.

In 2000, the third year of the fourth three-year rotation, IQs were 72,000 lbs. (32,659 kg) per licence as they were in 1997, 1998 and 1999. There were 31 licences assigned to the North Coast Area, 9 licences to the South Coast Inside Waters Area and 15 licences to the West Coast of Vancouver Island Area.

Data on number of participants, landings and value in this fishery are provided in Table 2.1.1.

2.1.2. Overview

2.1.2.1. Participants

The commercial fishery operates under license limitation: There are 55 commercial licenses (referred to as "G-tabs") which were fished on 42 vessels in 2000. The numbers of sport fishers is unknown, but catches are considered to be marginal. First Nation's participation in the fishery is currently limited to catches for food, social and ceremonial purposes, and is of unknown magnitude.

A summarized history of the fishery showing areas open, quotas, landings, reasons for management decisions and numbers of licenses and vessels is shown in Table 2.1.2.

2.1.2.2. Location

Commercial harvest of geoducks is limited to subtidal areas 10 feet (3 m) below chart datum. There are geoduck beds in each of the 29 Statistical Areas comprising the coast of British Columbia. Areas fished in 2000 are shown in Table 2.1.3, and include portions of Statistical Areas 1, 2, 13, 14, 15, 18, 19, 24, 25 and 29.

2.1.2.3. Time Frame

The license year is from January 1 to December 31 in each year. The location and schedule of openings and closings varies from year to year, but the potential to harvest is available for every day of a calendar year.

2.1.2.4. Landings/ Value/ Markets

Annual landings peaked at 12.6 million lb (5735 t) in 1987, and the commercial fishery has landed more than 152.4 million lb (69,133 t) over the period 1976 to 2000 (Table 2.1.1).

The price paid to fishers for geoduck has increased significantly since 1987. These increases are primarily due to premium prices paid for live geoducks in Hong Kong and the Peoples Republic of China. In 2000, prices varied between $4.25 and $12.00 per pound ($9.37 - $26.45 per kg) with an average of $10.26 per pound ($22.62 per kg). The total annual value of the fishery decreased from a record high of $43.3 million in 1995 to $40.6 million in 2000, and is the highest in value among shellfish species. This drop in value has been attributed to the recent decline in prices for most fish and shellfish exported to Asia and to the continuing presence, in international markets, of large quantities of cheaper product from Washington State.

Tables 2.1.4. and 2.1.5. provide annual catches by Management Area. The 2000 landings by Management Area and month are provided in Tables 2.1.6 and 2.1.7. The total validated landings, in 2000, of 3.96 million lb (1797 t) were slightly greater than the TAC by just over 0.02% or 979 lb (444 kg). A summary of quota overages in 2000 is shown in Table 2.1.8.

It is the current practice of fishers to catch just the amount of geoduck, in any fishing day, which is 'ordered' by a buyer. As a consequence, any previous measure of effort (catch per boat day, or diver-day, or hour) has little relationship with those measures from other years, or between boats. For this reason, no attempt has been made here to quantify effort in this fishery.

South Coast

The 2000 fishery occurred in the third year of the fourth rotation (Table 2.1.2). There were 24 IQs (44% of the licenses) assigned to the south coast in 2000, 9 for Inside waters and 15 for the W.C.V.I. Validated landings for 2000 in the south coast (Table 2.1.9.) were 1,728,281 lb (784 t). The 2000 landings were 648,219 lb (294 t) on the inside (219 lb or 99.3 kg over quota) and 1,080,062 lb (490 t) on the W.C.V.I. (62 lb or 28.1 kg over quota). Fishing took place all year for live markets.

The south coast inside/mainland waters have very large beds identified and measured which maintained an allocation in the south of 12 licences over the period 1989 to 1993, in spite of decreases in the quota and IQs. In 1994, the number of inside licences dropped to 10 and, in 1995, rose again to 11. In 1996, the number rose again to 13, then dropped again, in 1997, to 9 and stayed at 9 in 1998 through 2000. The 9 inside licenses were not consolidated and were fished on 9 separate vessels (Table 2.1.9).

The bed areas have been modified based on advice from fishers and on interpretations of landing data. Several bed closures were initiated over the period 1992 to 2000 (Table 2.1.10): These closures have not been evaluated.

The number of licences on the west coast was reduced each year, from 1989 through 1996, due to closures of heavily harvested areas and proportionally greater northern quotas. The exploratory fisheries in the south coast (Table 2.1.11), the surveys in the north and south coasts (Table 2.1.12) and the long term studies in the south coast (Table 2.1.13), initiated in 1996, are the start of the evaluation of these actions. The number of licences for the west coast, in 1997, was 17, an increase of 6 from the previous year and in 1998 through 2000 was 15, a drop of 2 from 1997 (Table 2.1.3). The 15 licenses on the west coast were consolidated on 13 vessels (Table 2.1.9). Two vessels fished two licences. Landings for 2000 are presented in Table 2.1.4.

The south coast areas have more bed area identified than the north coast. This has resulted in maintaining quotas in the south in spite of the long history of fishing. Some of the bed areas have been assessed and reduced and some beds have been closed due to concerns about overharvesting. Table 2.1.2 lists management actions and Table 2.1.3 lists the areas fished in the three-year rotations.

North Coast

The 2000 northern quota was 2,232,000 lb (1012.2 t). The northern area supported 31 licences, in 2000, each with an I.Q of 72,000 lb or 32.6 t (Table 2.1.3).

Validated landings in 2000 from the north coast were 2,232,698 lb (1013 t), somewhat over the quota by 698 lb (317 kg) (Table 2.1.5.). Prior to 1992, all product harvested from the north coast had to be processed due to PSP risk.

The 31 licences selected for the north coast were consolidated on 24 vessels (Table 2.1.9), with 6 vessels fishing 2 licences and one vessel fishing 3. No P-licences for processing on-board the vessel were active in 2000; this compares to as much as 40% of the catch processed by P-Licence vessels in 1991.

2.1.2.5. Consultative Process

Consultation is a major part of the planning for this fishery. The primary consultation is with the Sectoral Committee which includes representatives from DFO, the Canadian Food Inspection Agency, Environment Canada, the Provincial Ministry of Fisheries, licence holders, First Nations and sport fishing interests. There are at least two meetings a year, often more. At the first meeting, the wishes and comments from all sectors are solicited for consideration in drafting the fishing plan.

A draft fishing plan is distributed to all sectors in August. At a second meeting, the draft fishing plan is subject to comment from all sectors. These comments are considered in the drafting of the final plan.

As well as the previously mentioned scheduled consultations, there are many ad hoc consultations during the year with First Nations groups, Area Representatives of the license holders (there are three: North Coast, West Coast Vancouver Island and Inside Waters), other government agencies and other interest groups.

2.1.2.6. Management Styles

The fishery is managed by limiting harvest with a combination of a fixed exploitation rate applied to a total allowable catch (TAC), individual licence quotas (IQs), and a catch verification program.

The TAC is calculated by first calculating the unharvested ('virgin') biomass (the product of the bed area, the virgin geoduck density and mean individual geoduck weight) and applying a harvest rate of 1 percent.

This TAC is divided into 55 equal quotas after deductions have been made for product harvested in scientific surveys and biotoxin monitoring programs.

A third party validation company, paid for by the harvesters association (the Underwater Harvesters Association or UHA) verifies all landings.

2.1.3. Stock Status

2.1.3.1. Biology

The geoduck clam, *Panopea abrupta*, is found from Alaska to the Gulf of California from the intertidal to a maximum depth of at least 110 m. Geoducks bury themselves in soft substrates to depths of up to one metre.

Sexes are separate and spawning occurs from June to July. Ripe gonads are found in clams ranging from seven to 107 years old.

Geoducks grow rapidly in the initial 10 to 15 years, and often reach ages in excess of 100 years. The oldest known geoduck on record lived to an estimated 149 years. Recruitment to the fishery begins at age four: geoducks are fully recruited by age 12.

2.1.3.2. Assessment

PSARC stock assessment papers are produced covering two-year periods. The most recent covered the period 2000/2001. Quota calculations from these documents form the scientific basis of the Management Plan. These assessments incorporate the latest information from surveys and observer fisheries, and consider advice from PSARC and from industry.

2.1.3.3. Research

DFO and commercial geoduck divers have carried out a number of density surveys and research studies since 1990, initially at Gabriola Island and Ritchie Bay and more recently, since 1993, in co-operation with First Nations in the north and south coast. Tables 2.1.12 and 2.1.13 summarize survey and research activities in 2000.

2.1.3.4. Prospects

Stock assessment advice from assessments done for the years 1997-2001 have not resulted in changing annual quotas over that time period. New information (bed sizes, densities, and weights of animals) has not required the large quota reductions experienced during the years from 1989 through 1996.

The commercial fleet has explored and discovered most of the productive ground in the south coast, whereas new beds are still being discovered in the north coast of B.C.

2.1.4. Current Management Issues

2.1.4.1. Annual assessments and reductions in quotas

From 1991 until 1997, the fishery faced a reduction in quotas annually. A two-year plan was set for 1992-1993 to give some stability to the fishery while an assessment was carried out. Annual assessments and reductions have occurred through 1996. In 1997, a two-year assessment covering 1997 and 1998 was conducted. Uncertainties remain about average densities, the size of geoduck beds and recruitment and mortality rates.

Although the reductions in quota have been compensated by dramatic increases in the prices paid for geoducks sent to live markets, fishers feel that these reductions send a signal to the market that the industry lacks stability. Fishers requested unchanging quotas over several years. Equal sized quotas of 72,000 lb (32.6 t) were in place in 1997 through 1999 and remain in place for the 2000 fishing year.

Fishers would like to see a small increase in quota which they believe would signal to markets that the Department views the fishery as a sustainable one.

2.1.4.2. High-grading

There are continued reports of dumping of low quality geoducks, or "high-grading". Competition with quantities of geoducks from Puget Sound (some alleged to have been high-graded) may be an incentive for high-grading in Canada. There is, however, pressure from within industry to land and sell all geoducks regardless of their size and quality.

2.1.4.3. Poaching

Anecdotal information indicates that, as a consequence of the current high prices paid for geoducks, poaching has increased and may be a significant problem. It is reported that much of the product taken illegally is sold domestically and is not showing up in foreign markets.

The amount of poaching is unknown, but not considered, by the industry or managers, to be at a level where there are conservation concerns. The problem is more one of health and safety as poached product may have come from contaminated areas or areas with high PSP levels and cannot be considered safe for human consumption. Poached product is generally sold at lower prices and this has an effect on the market.

Little is being done to address this problem except that the UHA has directed some effort towards following up on some reported incidents. They have also offered to help defray the costs of a fishery officer dedicated to enforcement in the geoduck fishing industry.

2.1.4.4. Catch and Value Record

Although accurate geoduck catches are available through the catch validation program, catch and value data, which in the past was captured through fish slips, is unreliable. The true ex-vessel value of this fishery can only be estimated from interviews with either fishers or buyers.

2.1.4.5. Aquaculture and Enhancement

Brood stock from Marina Island was first collected in 1993 and juvenile seed geoducks have been produced at a hatchery in Qualicum, B.C. The commercial harvesters, the U.H.A. and a private aquaculture company have jointly supported this hatchery program.

Five areas were selected as experimental sites for aquaculture, two at Marina Island, two at Savary Island and one at Texada Island. FAN Seafoods now has 5-year leases on these areas, and is seeding with juvenile geoducks from the hatchery at Qualicum. The project will be evaluated in year 5 jointly by DFO, FAN and MAFF.

There has been a continuation of the harvest of wild stocks at the Marina Island, Texada Island and Savary Island sites by the U.H.A. prior to seeding so as to 'purge' the sites of wild geoducks. These landings have been applied against IQs and area quotas. When wild stock is removed and the sites are seeded, the areas will be removed from the wild fishery. FAN Seafoods has agreed that residual wild geoducks remaining on the sites, when harvested, should be applied against a G license and the area quota. A non-destructive method for discriminating between wild and cultured geoducks has yet to be developed. Table 2.1.14 summarizes 1999 harvest activities and landings. Table 2.1.15 summarizes historical 'purge' harvest activities and landings. Monitoring of harvest activities at aquaculture sites is required.

FAN has harvested about 500 lb from their aquaculture sites in 1999 for a 'market evaluation'. They intend to harvest an additional 11,000 lb in 2000 to sell commercially.

The UHA has embarked on an 'enhancement' program that involves seeding several sites in the Strait of Georgia and a site at Ritchie Bay in Clayoquot Sound. The UHA has not developed a seeding plan or study design. The enhancement activities of the UHA differ from the aquaculture activities of FAN in that the enhancement activities carry no claim of ownership of the animals seeded. The UHA has some expectation of benefit from their activities, but this has not been made explicit. Consequently, the impact of enhancement activities on the wild fishery or its assessment and management cannot be evaluated.

The Province has requested that some control functions be applied to the UHA activities since their enhancement use constitutes occupation of subtidal land under its jurisdiction.

The UHA is currently experimenting with a seed-planting device for juvenile geoducks. No evaluation of enhancement success has yet been made.

2.1.5. Long Term Objectives for the Fishery

There are objectives for this fishery which are shared by all others: These are to understand oceans and aquatic resources, to manage and protect the fisheries resource, to maintain and protect the marine and freshwater environment, to maintain maritime safety, and to facilitate maritime trade, commerce and ocean development.

2.1.6. Specific Management Objectives

2.1.6.1. Conservation/ Sustainability

The biological objective of this fishery is to harvest the available biomass on a sustainable basis, and to manage this, where possible, on a bed quota basis. The management objectives are to accomplish this biological objective by harvesting 1% of the estimated virgin biomass annually, setting individual vessel quotas, validating landings and employing rotational fisheries.

2.1.6.2. Domestic Considerations

Commercial Fishery

Other objectives are to maintain an orderly supply of product to the market, to establish and monitor conditions of harvest to develop knowledge of the stock, to allow for other production such as enhancement, aquaculture and depuration fisheries, to encourage exploration in unexploited areas, to provide for marine protected areas, marine parks and ecological reserves, and to provide for aboriginal food, social and ceremonial needs.

Experimental Fishery

Exploratory activities, that is activities in areas where there are no known beds, is managed by a protocol which allows fishing at a low level to proceed under observation by a third party. A vessel fishes a small amount of product, then moves to a new location in a systematic pattern. Data from the activity may indicate that there is enough product to warrant a survey in the area. The survey will provide data which will allow the calculation of a quota.

2.1.7. Fishery Management Measures

2.1.7.1. Fishing Season

Table 2.1.3 shows a historical list of areas and quotas fished from 1989 (the year of the implementation of IQs) through 2000.

2.1.7.2. Control and Monitoring of Fishing Activities

The fishery in the north is organized and scheduled through on-grounds monitoring by a charter vessel which also prevents conflict with the herring fishery and herring spawn.

2.1.7.3. Quota Allocations

Quotas limit catches. Quotas are determined by estimating biomass based on estimates of density, bed area and mean weights, and applying an annual harvest rate which yields a harvest equal to 1% of the original unharvested biomass. The bed area and catch information are retrieved from logbook data and charts and from catch statistics and are reviewed annually with fishers. The coastwide quota is divided into 55 equal quotas, one for each license. An independent validation company monitors catches.

In the years between 1979 (when area quotas were implemented) and 1989 (when individual vessel quotas were implemented), quotas varied considerably, from a low of 6.2 million lb (2801t) in 1981 to a high of 9.3 million lb (4238 t) in 1987. In 1982, and the years from 1984 through 1988, coastwide quotas were exceeded each year (Table 2.1.2). Since 1990, the second year of vessel quotas, the TAC and vessel quotas have fallen by a range of 7-16% per year (Table 2.1.2) due, in large part, to revised estimates of bed size and densities used in quota calculations.

2.1.7.4. Other Relevant Elements

Licensing

The coast is divided into 3 license areas, the north coast, the west coast of Vancouver Island, and waters inside Vancouver Island. The number of licences fishing each area may change annually according to the proportion of the total quota assigned to each area (Table 2.1.2). Until 1997, there was a shift in licences to the north coast as new areas were identified there and quotas were reduced in the south to compensate for what now appears to have been previous overharvesting. In 1997, two licenses from the north and 4 licenses from the inside moved to the west coast of Vancouver Island, leaving 29 licences in the north, 9 in southern inside waters and 17 on the west coast of Vancouver Island. In 1998 and 1999, there was no net movement of licenses between areas.

P-licences for processing at sea have been issued for the north coast and the option has been available for the W.C.V.I. since 1992. There has been no processing at sea in the south due to higher prices for live geoducks.

Conservation and Harvesting Techniques

A harvest rate of 1 percent of the original biomass has generally been considered 'risk-averse'. The method of harvest, (employing high-pressure water to loosen clams in the substrate) is very selective, and by-catch of other species, other than horse clams, is negligible. Harvest and retention of horse clams is managed under the G license, and is restricted to animals taken incidentally in the geoduck harvest: There is no directed fishery on horse clams.

Some high grading (discarding less desirable animals) occurs in this fishery when dark individuals or those of poor appearance or damaged in harvest are not retained. This is not, however, considered to be a major conservation issue.

2.1.8. Enforcement Issues and Strategies

The validation company reports few incidents requiring reports to DFO (Table 2.1.16). Harvesting of geoducks by unlicensed operators (poaching) and high-grading (sorting and retaining only high quality product) are the main concerns for enforcement personnel.

2.1.9. Financial Responsibilities

2.1.9.1. Industry

The Underwater Harvesters Association (UHA) contributes to a water quality and shoreline assessment program carried out by D.O.E. and to a coastwide PSP sampling program. They also offset the salary of one full-time management biologist for DFO. Other projects funded include several surveys for stock assessment purposes, enhancement activities (seeding juvenile geoducks), a market sampling program and a validation program, the latter essential for the proper functioning of the IQ system. The UHA has also funded several ad hoc projects such as an unanticipated shell ageing project.

2.1.9.2. DFO

DFO provides, in support of this fishery, stock assessment, management of the fishery and enforcement activities.

Table 2.1.1. Number of licences issued, number of vessels, licence quotas, coastwide quotas, landings and landed value of geoduck clams in British Columbia as reported on sales slips (1976-1988) and on validation logs (1990-2000).

Year	Licences Issued	Vessels with Landings	Quota per license		Coastwide Quota		Total Landings		Total Value[1]	Mean Price[2]		Price Range[2] (Can. $)	
			(lb)	(kg)	(lb)	(t)	(lb)	(t)	$\$10^{-3}$	($·lb)	($·kg)	($·lb)	($·kg)
1976	7	5	N/A	N/A	no quota		97,002	44	N/A	N/A	N/A	N/A	N/A
1977	30	14	N/A	N/A	no quota		540,898	245	89	0.17	0.37	N/A	N/A
1978	54	27	N/A	N/A	no quota		2,239,950	1,016	569	0.25	0.55	0.15 - 0.35	0.33 - 0.77
1979	101	72	N/A	N/A	8,000,000	3,628	5,429,886	2,463	1,669	0.31	0.68	0.13 - 0.40	0.29 - 0.88
1980	95	63	N/A	N/A	8,000,000	3,628	6,186,067	2,806	2,299	0.37	0.82	0.30 - 0.48	0.66 - 1.06
1981	52	49	N/A	N/A	6,176,000	2,801	5,961,405	2,704	2,162	0.36	0.79	0.32 - 0.70	0.71 - 1.54
1982	52	53	N/A	N/A	6,500,000	2,948	6,910,800	3,134	2,814	0.40	0.89	0.22 - 0.46	0.44 - 1.01
1983	54	53	N/A	N/A	6,500,000	2,948	5,810,913	2,635	1,804	0.31	0.68	0.00 - 0.60	0.00 - 1.32
1984	54	44	N/A	N/A	6,600,000	2,993	7,678,465	3,484	2,937	0.38	0.84	0.00 - 0.95	0.00 - 2.09
1985	55	52	N/A	N/A	6,550,000	2,970	11,838,624	5,370	4,599	0.40	0.89	0.00 - 1.00	0.00 - 2.20
1986	55	55	N/A	N/A	8,775,000	3,980	11,035,396	5,005	4,605	0.39	0.86	0.00 - 0.85	0.00 - 1.87
1987	55	56	N/A	N/A	9,345,000	4,239	12,643,298	5,735	6,184	0.49	1.08	0.00 - 1.05	0.00 - 2.31
1988	55	56	N/A	N/A	8,575,000	(3,772)[3]	10,068,830	4,567	9,807	0.97	2.14	0.03 - 1.88	0.07 - 4.14
1989	55	47	160,000	72,576	8,800,000	3,992	8,784,247	3,985	12,571	1.43	3.15	0.25 - 1.75	0.55 - 3.85
1990	55	46	160,000	72,576	8,800,000	3,992	8,722,366	3,956	10,581	1.21	2.67	0.14 - 2.27	0.31 - 5.00
1991	55	47	135,000	61,236	7,425,000	3,367	7,346,864	3,333	9,659	1.29	2.84	0.58 - 2.55	1.27 - 5.62
1992	55	45	114,750	52,051	6,311,250	2,863	6,313,748	2,864	16,237	2.56	5.64	1.60 - 5.01	3.53 - 11.04
1993	55	44	97,500	44,226	5,362,500	2,432	5,365,420	2,434	26,994	4.99	11.00	1.00 - 9.38	2.20 - 20.68
1994	55	45	90,000	40,824	4,950,000	2,245	4,908,523	2,227	33,552	6.87	15.15	1.20 - 9.00	2.66 - 19.84
1995[4]	55	45 (42)	84,030	38,116	4,621,650	2,097	4,624,330	2,098	43,284	9.36	20.63	3.50 - 15.00	5.86 - 33.07
1996[4]	55	47 (44)	73,785	33,469	4,058,175	1,841	4,059,917	1,842	36,271	8.93	19.68	6.06 - 12.00	13.36 - 26.46
1997	55	42	72,000	32,659	3,960,000	1,796	3,960,083	1,796	33,264	8.41	18.54	2.50 - 11.00	5.41 - 24.25
1998	55	42	72,000	32,659	3,960,000	1,796	3,960,755	1,797	29,785	7.52	16.58	2.00 - 11.00	4.41 - 24.25
1999	55	41	72,000	32,659	3,960,000	1,796	3,960,676	1,797	33,661	8.28	18.25	2.00 - 10.50	4.41 - 23.15
2000	55	42	72,000	32,659	3,960,000	1,796	3,960,979	1,797	40,635	10.26	22.62	4.25 - 12.00	9.37 - 26.45
Total:							152,409,442	69,132	366,032				

[1] Price ranges taken from market reports and sales slips.

[2] Price paid to commercial fishermen.

[3] Quotas in pounds and metric tonnes are not equal.

[4] Licence transfers between vessels occurred mid-season. The number in parentheses is the number of vessels holding licences at year end.

Table 2.1.2. Summary of quotas, landings and management actions from 1976 to 2000.

Year	Management Units Areas	Quota (tonnes)	Quota (pounds)	Landings[1-4] (tonnes)	Landings[1-4] (pounds)	Management	Eligible Licences	Vessels Fished
1976	South Coast, Strait of Georgia	No quotas		44	97,002	Five operators harvested in designated areas in the Strait of Georgia.	7	5
1977	Coastwide opening	No quotas		245	540,898	All landings from south coast - Strait of Georgia and Tofino region (Area 24).	30	14
1978	Coastwide opening	No quotas		1,016	2,239,950	Licences issued pursuant to Pacific Shellfish Regulations - mechanical harvesting.	54	27
1979	North Coast - 1 management unit	1,587	3,499,449	0	0	Because of increase in effort and landings, licence moratorium and quotas were introduced. South coast Areas 13-19 and 24 were closed Sept. 29, 1979. Other areas in Strait of Georgia and west coast Vancouver Island open to Dec. 31	101	72
	South Coast - 1 management unit	2,041	4,500,551	2,463	5,429,886			
	Totals	3,628	8,000,000	2,463	5,429,886			
1980	North Coast - 4 management units	1,587	3,499,449	68	148,581	Licences limited, South coast areas closed by August 31. First landings from north coast fishery.	95	63
	South Coast - 8 management units	2,041	4,500,551	2,738	6,037,486			
	Inside - 5 units	771	1,700,110	980	2,160,970			
	West Coast - 3 units	1,270	2,800,441	1,758	3,876,516			
	Totals	3,628	8,000,000	2,806	6,186,067			
1981	North Coast - 11 management units	986	2,174,058	509	1,122,173	Licences limited based on previous landing criteria of 13.6 t in 1978 or 1979 for licence eligibility. Closure of areas on west coast of Vancouver Island during herring season. Quotas grouped in-season to 6 units.	52	49
	South Coast - 10 management units	1,815	4,001,942	2,195	4,839,232			
	Inside - 7 units	397	875,356	547	1,205,950			
	West Coast - 3 units	1,416	3,126,586	1,648	3,633,282			
	Totals	2,801	6,176,000	2,704	5,961,405			
1982	Coastwide opening	2,948	6,500,000	3,135	6,910,800	With whole coast open, majority of landings came from south coast. Coast closure on September 1, 1982. Pearse Commission recommended a vessel quota and area licencing system.	52	53
1983	North Coast - 3 management units	907	1,999,830	502	1,107,051	Some areas open to December 31, Return to management units. Introduction of vessel G licence, transferable to a vessel of equal or shorter length. Grading introduced by processors - problems with product dumping on the fishing grounds.	54	53
	South Coast - 2 management units	2,041	4,500,170	2,134	4,706,068			
	Inside - 1 unit	454	1,001,018	481	1,060,740			
	West Coast - 1 unit	1,587	3,499,152	1,653	3,645,328			
	Totals	2,948	6,500,000	2,636	5,810,913			

Table 2.1.2. continued

Year	Management Units Areas	Quota (tonnes)	Quota (pounds)	Landings[1,2] (tonnes)	Landings[1,2] (pounds)	Management	Eligible Licences	Vessels Fished
1984	North Coast - 3 management units	907	2,000,067	575	1,267,255	Catch and effort increased. Exploratory areas opened in winter to maintain year round fishery. Vessel processing licenced.	54	44
	South Coast - 12 management units	2,086	4,599,933	2,909	6,411,210			
	Inside - 6 units	680	1,499,499	1,175	2,589,609			
	West Coast - 6 units	1,406	3,100,434	1,734	3,821,601			
	Totals	2,993	6,600,000	3,484	7,678,465			
1985	North Coast - 4 management units	907	2,000,286	1,436	3,165,785	Openings were set to maintain a year round supply of geoducks for live markets. Several exploratory quotas set.	55	52
	South Coast - 19 management units	2,063	4,549,714	3,934	8,672,839			
	Inside - 10 units	748	1,649,630	1,056	2,325,838			
	West Coast - 9 units	1,315	2,900,084	2,878	6,344,797			
	Totals	2,970	6,550,000	5,370	11,838,624			
1986	North Coast - 11 management units	1,474	3,249,837	1,692	3,730,647	South coast quotas increased. North coast quotas 1.5 million pounds.	55	55
	South Coast - 22 management units	2,506	5,525,163	3,313	7,304,749			
	Inside - 11 units	919	2,026,187	1,119	2,467,254			
	West Coast - 11 units	1,588	3,501,181	2,194	4,837,494			
	Totals	3,980	8,775,000	5,005	11,035,396			
1987	North Coast - 16 management units	1,606	3,545,720	2,148	4,735,450	Quotas increased coastwide based on new grounds and exploratory fisheries. All north coast quotas taken for the first time.	55	56
	South Coast - 27 management units	2,630	5,799,280	3,587	7,907,848			
	Inside - 13 units	839	1,850,037	1,448	3,192,240			
	West Coast - 14 units	1,792	3,951,449	2,139	4,715,608			
	Totals	4,236	9,345,000	5,735	12,643,298			
1988	North Coast - 16 management units	1,576	3,475,000	2,026	4,466,707	South coast quotas reduced by 700,000 lb. Quotas calculated from log book data, some exploratory fishing.	55	56
	South Coast - 27 management units	2,314	5,100,000	2,541	5,602,123			
	Inside - 11 units	794	1,750,000	995	2,193,669			
	West Coast - 16 units	1,520	3,350,000	1,546	3,408,454			
	Totals	3,890	8,575,000	4,567	10,068,830			
	FIRST THREE YEAR ROTATION							
1989	North Coast - 7 management units	1,597	3,520,441	1,600	3,526,040	First year of trial I.Q. Coastwide quota divided equally among 55 licences; 160,000 lb. Area licensing: 12 inside south, 21 west coast Vancouver Is., 22 north coast licences. Three year area rotation initiated.	55	47
	South Coast - 9 management units	2,395	5,279,559	2,386	5,258,207			
	Inside - 4 units	871	1,920,040	870	1,917,284			
	West Coast - 5 units	1,524	3,359,519	1,516	3,340,923			
	Totals	3,992	8,800,000	3,986	8,784,247			

Table 2.1.2. continued

Year	Management Units Areas	Quota (tonnes)	Quota (pounds)	Landings^{1,2} (tonnes)	Landings^{1,2} (pounds)	Management	Eligible Licences	Vessels Fished
1990	North Coast - 5 management units	1,597	3,520,441	1,596	3,518,932	Second year of trial I.Q. 160,000 lb/licence. Year two of the three year area rotation.	55	46
	South Coast - 13 management units	2,395	5,279,559	2,360	5,203,434			
	Inside - 5 units	871	1,920,040	864	1,904,986			
	West Coast - 8 units	1,524	3,359,519	1,497	3,300,653			
	Totals	3,992	8,800,000	3,956	8,722,366			
1991	North Coast - 19 management units	1,347	2,970,441	1,327	2,925,079	Third year of I.Q. 135,000 lb/licence (15.6% reduction) Year three of the three year area rotation.	55	47
	South Coast - 22 management units	2,020	4,454,559	2,006	4,421,785			
	Inside - 10 units	735	1,620,842	734	1,617,941			
	West Coast - 12 units	1,286	2,835,922	1,272	2,803,844			
	Totals	3,367	7,425,000	3,333	7,346,864			
	SECOND THREE YEAR ROTATION							
1992	North Coast - 24 management units	1,197	2,638,689	1,199	2,643,221	Year one of second area rotation. I.Q. 114,750 lb/licence. (15% reduction) 23 licenses North, 12 Inside South, 20 WC Vancouver Is.	55	45
	South Coast - 37 management units	1,666	3,672,561	1,665	3,670,527			
	Inside - 16 units	625	1,377,762	625	1,377,826			
	West Coast - 21 units	1,041	2,294,800	1,040	2,292,702			
	Totals	2,863	6,311,250	2,864	6,313,748			
1993	North Coast - 27 management units	1,061	2,339,479	1,063	2,343,238	Second year of second area rotation. I.Q. 97,500 lb/licence. (15% reduction) 24 licences North; 12 Inside South; 19 W.C. Vancouver Is.	55	44
	South Coast - 20 management units	1,371	3,023,021	1,371	3,022,182			
	Inside - 7 units	507	1,117,922	531	1,170,517			
	West Coast - 13 units	840	1,852,179	840	1,851,665			
	Totals	2,432	5,362,500	2,434	5,365,420			
1994	North Coast - 32 management units	1,102	2,429,800	1,091	2,404,669	Third year of second area rotation. I.Q. 90,000 lb./licence (7.7% reduction) 27 licences North, 10 Inside South; 18 W.C. Vancouver.Is.	55	45
	South Coast - 30 management units	1,143	2,520,200	1,136	2,503,854			
	Inside - 15 units	408	899,599	408	899,271			
	West Coast - 15 units	735	1,620,601	728	1,604,582			
	Totals	2,245	4,950,000	2,227	4,908,523			
	THIRD THREE YEAR ROTATION							
1995	North Coast - 38 management units	1,144	2,520,199	1,145	2,524,968	Year 1 of the third area rotation. I.Q. 84,030 lb/licence (6.6% reduction) 30 licences North, 11 Inside South; 14 W.C.Vancouver Is.	55	44
	South Coast - 41 management units	953	2,100,349	952	2,099,362			
	Inside - 16 units	419	923,448	419	923,984			
	West Coast - 25 units	534	1,176,901	533	1,175,378			
	Totals	2,097	4,621,650	2,097	4,624,330			

Table 2.1.2. continued

Year	Management Units Areas	Quota (tonnes)	 (pounds)	Landings[1,2] (tonnes)	 (pounds)	Management	Eligible Licences	Vessels Fished
1996	North Coast - 43 management units	1038	2,287,243	1038	2,287,836	Year 2 of the third area rotation. I.Q. 73,785 lb/license (13.9% reduction) 31 licenses North, 13 Inside South; 11 W.C. Vancouver Is.	55	47
	South Coast - 26 management units	803	1,770,932	804	1,772,081			
	Inside - 10 units	435	959,209	436	960,979			
	West Coast - 16 units	368	811,723	368	811,102			
	Totals	1841	4,058,175	1842	4,059,917			
1997	North Coast - 50 management units	947	2,087,960	947	2,088,004	Year 3 of the third area rotation. I.Q. 72,000 lb/license (2.5% reduction) 29 licenses North, 9 Inside South; 17 W.C. Vancouver Is.	55	42
	South Coast - 37 management units	849	1,872,040	849	1,872,079			
	Inside - 16 units	294	647,980	294	647,994			
	West Coast - 21 units	555	1,224,060	555	1,224,086			
	Totals	1796	3,960,000	1796	3,960,083			
	FOURTH THREE YEAR ROTATION							
1998	North Coast - 51 management units	1012	2,232,000	1013	2,232,486	Year 1 of the fourth area rotation. I.Q. 72,000 lb/license (no reduction) 31 icenses North, 9 Inside South, 15 W.C. Vancouver Is.	55	42
	South Coast - 42 management units	784	1,728,000	784	1,728,269			
	Inside - 19 units	294	648,000	294	648,084			
	West Coast - 23 units	490	1,080,000	490	1,080,185			
	Totals	1796	3,960,000	1797	3,960,755			
1999	North Coast - 52 management units	1012	2,232,000	1013	2,232,273	Year 2 of the fourth area rotation. I.Q. 72,000 lb/license (no reduction) 31 icenses North, 9 Inside South, 15 W.C. Vancouver Is.	55	42
	South Coast - 26 management units	784	1,728,000	784	1,728,403			
	Inside - 11 units	294	648,000	294	648,236			
	West Coast - 15 units	490	1,080,000	490	1,080,167			
	Totals	1796	3,960,000	1797	3,960,676			
2000	North Coast - 64 management units	1012	2,232,000	1013	2,232,694	Year 3 of the fourth area rotation. I.Q. 72,000 lb/license (no reduction) 31 licenses North, 9 Inside, 15 W.C. Vancouver Is.	55	42
	South Coast - 34 management units	784	1,728,000	784	1,728,302			
	Inside - 18 units	294	648,000	294	648,237			
	West Coast - 16 units	490	1,080,000	490	1,080,065			
		1796	3,960,000	1797	3,960,996			

[1] Reported landings from sales slip submissions. 1989 to 2000 landings are I.Q. validated weights.

[2] There are minor differences between this Table and Table 2.1.1 due to rounding.

Table 2.1.3. Summary of geoduck quotas in lb with kg in [brackets] and rotation of areas for 1989 to 2000, and proposed fishing areas and quotas for the 2001 fishery.

	Inside Waters		West Coast V.I.		North Coast		Annual	Annual
Year	Areas	Quota (Vessels)	Areas	Quota (Vessels)	Areas	Quota (Vessels)	Quota	I.V.Q.
First Rotation (1989-1990-1991)								
1989	11, 12, 13	1,920,000 (12) [870,748 kg]	23, 24, 27A	3,360,000 (21) [1,523,810 kg]	lower 6, 7 to 10	3,520,000 (22) [1,596,372 kg]	8,800,000 [3,390,930 kg]	160,000 [72,562 kg]
1990	14, 16	1,920,000 (12) [870,748 kg]	24, 26, 27H, 27I	3,360,000 (21) [1,523,810 kg]	3, 4, 5, upper 6	3,520,000 (22) [1,596,372 kg]	8,800,000 [3,390,930 kg]	160,000 [72,562 kg]
1991	15, 17, 18, 19, 29-5	1,620,000 (12) [734,694 kg]	20, 24, 25, 26B1 26B2 26C	2,835,000 (21) [1,285,714 kg]	1, 2E, 2W	2,970,000 (22) [1,346,939 kg]	7,425,000 [3,367,347 kg]	135,000 [61,224 kg]
Second Rotation (1992-1993-1994)								
1992	12, 13, 14A, 14B, 14C	1,377,000 (12) [624,490 kg]	23, 24A, 24A2, 24A3, 24B, 24B2, 24B3 27A, 27B, 27D, 27E 27F, 27G, 27H, 27I	2,295,000 (20) [1,040,816 kg]	lower 6, 7 to 10	2,639,250 (23) [1,196,939 kg]	6,311,250 [2,862,245 kg]	114,750 [52,041 kg]
1993	14D, 14E, 16	1,170,000 (12) [530,612 kg]	24A, 24A2, 24A3, 24B, 24B2, 24B4, 26A, 26B2, 26D, 27H	1,852,500 (19) [840,136 kg]	3, 4, 5, upper 6	2,340,000 (24) [1,061,224 kg]	5,352,500 [2,431,973 kg]	97,500 [44,218 kg]
1994	15A, 15B, 15C, 15D 15E, 15F, 15G 17A, 17B, 18A 18B, 19A, 19B 19C, 29-4, 29-5	900,000 (10) [408,163 kg]	24A2,24A3,24A4,24A5 24A6,24B1,24B2,24B3, 24B4, 25A, 25B, 25C, 25D	1,620,000 (18) [734,694 kg]	1, 2E, 2W	2,430,000 (27) [1,102,041 kg]	4,950,000 [2,244,898 kg]	90,000 [40,816 kg]
Third Rotation (1995-1996-1997)								
1995	12A, 12C, 12D, 12F, 12G 13A,13C,13D,13E 14A, 14B, 14C	924,330 (11) [419,197 kg]	23A,23B,23C,23D,23E 24A2,24A3,24A4,24A5 24B1,24B2,24B3,24B4 24C 27A,27B,27C,27D,27E, 27G,27H,27I	1,176,420 (14) [533,524 kg]	lower 6, 7 to 10	2,520,900 (30) [1,143,265 kg]	4,621,650 [2,095,986 kg]	84,030 [38,109 kg]
1996	12B1, 12B2 14D, 14E 16A, 16B, 16C, 16D 16E, 16F	959,205 (13) [435,014 kg]	24A2, 24A3, 24A4 24A5, 24A6, 24B1 24B2, 24B3, 24B4 24C1, 24C2, 24D1 25A, 25B, 25C, 25D	811,635 (11) [368,088 kg]	3, 4, 5, upper 6	2,287,335 (31) [1,037,340 kg]	4,058,175 [1,840,442 kg]	73,785 [33,463 kg]
1997	13A, 13B, 13C, 13D 15A, 15B, 15C1, 15C2, 15D, 15E, 15F, 15G 15H, 15I 18A, 18B 19A, 19B, 19C	648,000 (9) [293,878 kg]	24A2a, 24A2b, 24A3 24A4, 24A5, 24A6a 24A6b, 24B1, 24B2 24B3, 24B4, 24C1 24C2, 24D1, 24D2 25A, 25B, 25C, 25D	1,224,000 (17) [555,102 kg]	1, 2E, 2W	2,088,000 (29) [946,939 kg]	3,960,000 [1,795,918 kg]	72,000 [32,653 kg]
Fourth Rotation (1998-1999-2000)								
1998	12A, 12B3, 12C, 12D, 12E, 12G 13E 14A1, 14A2, 14B, 14C, 17A1, 17A2 17A3, 17B, 29	648,000 (9) [293,878 kg]	23A, 23B, 23C, 23D 23E, 24A2a, 24A2b 24A4,24A6a, 24A6b 24B1, 24B2, 24B3 24B4, 24D2, 27A 27B, 27C, 27D, 27H, 27I	1,080,000 (15) [489,796 kg]	lower 6, 7 to 10	2,232,000 (31) [1,012,245 kg]	3,960,000 [1,795,918 kg]	72,000 [32,653 kg]
1999	14D, 14E 16A, 16B, 16C, 16D 16E, 16F	648,000 (9) [293,878 kg]	24A2a, 24A2b, 24A4, 24A5, 24A6a, 24A6b 24B1, 24B2, 24B3, 24B4, 24C1 26A, 26B, 26C, 26D	1,080,000 (15) [489,796 kg]	3, 4, 5, 6, 106	2,232,000 (31) [1,012,245 kg]	3,960,000 [1,795,918 kg]	72,000 [32,653 kg]
2000	13A, 13C, 13D 14B 15A, 15B, 15C, 15D, 15E, 15F, 15G, 15H, 15I, 18A, 18B 19B, 19C	648,000 (9) [293,878 kg]	24A2a, 24A2b, 24A3, 24A4, 24A5, 24A6a, 24A6b 24B1, 24B2, 24B3, 24B4, 24C 25A, 25B, 25C, 25D	1,080,000 (15) [489,796 kg]	1, 2	2,232,000 (31) [1,012,245 kg]	3,960,000 [1,795,918 kg]	72,000 [32,653 kg]
2001	12A1, 12A2 12B1A 12B1B, 12B2, 12B3 12B4, 12C, 12G 13E, 14A1, 14A2, 14B, 14C1, 14C2, 14C3 17A1, 17A2, 17A3, 17B1, 17B2, 17B3, 17B4 19B, 19C, 29	516,000 (7) (14,612 kg)	23A,23C, 23D, 23E1, 23E2 24A2A,24A4, 24A6A 24B1A, 24B1B, 24B3, 24B4, 24C1 27A, 27H, 27I	1,095,000 (15) (496,682 kg)	6, 7, 8, 9, 10	2,409,000 (33) (1,092,722 kg)	4,015,000 (1,821,204 kg)	73,000 (33,113 kg)

Table 2.1.4. Summary of geoduck landings (tonnes) by South Coast Management Area, as reported on sales slips (1976 to 1988) and on validation logs (1989-2000). A three year rotation of areas was initiated in 1989, with the exception of area 24.

	SOUTH COAST MANAGEMENT AREAS																				
	East Coast Vancouver Island											West Coast Vancouver Island									Annual
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	111		Landings
1976				10			8		26												44
1977			14	9	77		137	2						6							245
1978			8	261	321	3	24	19	136			1	3	2	236	2					1,016
1979		24	160	276	263	148	209	3	159					153	950	87	22	9			2,463
1980			97	215	17	301	225	34	91			5		288	841	321	303				2,738
1981			41	180	29	70	155	44	28			8		187	819	473	156	6			2,196
1982		83	14	144	33	103	17	1	14			14		174	1218	366	726				2,907
1983		16	29	340	29	42	#	#	10					84	1066	215	287	#			2,134
1984	8	302	150	285	54	129	128	#	118					219	628	442	443	#			2,909
1985	13	490	81	172	42	38	137	#	76					227	730	599	272	1050			3,933
1986	#	212	148	200	137	117	136	13	124		11	96		231	803	450	226	388			3,313
1987		275	112	286	98	159	265	103	50		100	40		247	661	552	398	241			3,587
1988	62	290	51	191	59	95	110	#	116	#	#	49		192	633	187	206	279			2,540
1989	#	662	203						#					538	633			345			2,386
1990				605		256									540		614	343			2,360
1991					258		181	37	244		14	#			416	702	153				2,006
1992		256	78	291										255	479			306			1,665
1993			#	349	#	182									497		220	124			1,372
1994			#		181		134	20	64		10				232	496					1,137
1995		80	54	282		3								129	188			210	#		952
1996		96		195	43	102					#				239		129				804
1997			47		241	5									162	393					848
1998		55	1	170	14	4	50							118	158			214			784
1999			3	177	24	90					#				385		105				784
2000			46	81	124	3		3	37						405	85					784
1976 to 1999	109	2,841	1,337	4,720	2,044	1,851	1,929	288	1,295	1	152	214	3	3,050	12,919	5,370	4,260	3,518	6		45,906

Inside Waters Total: 16,567

West Coast Total: 29,340

* Less than 0.5 t.

# Data does not meet confidentiality requirements.

Table 2.1.5. Summary of geoduck landings (tonnes) by North Coast Management Area, as reported on sales slips (1980 to 1988) and on validation logs (1989-2000). A three year rotation was introduced in 1989.

	NORTH COAST MANAGEMENT AREA												
Year	1	2E	2W	3	4	5	6	7	8	9	10	106	Annual Landings
1980		31			4					28	5		68
1981		11				84	6	370	18		20		509
1982								227					227
1983								202	299		#		501
1984		4		3		214	8	109	183	54			575
1985		341	213			291	60	494	37				1,436
1986	7	254	325	120	125	323	24	392	2	103	17		1,692
1987	137	391	179	134	95	287	484	222	91	11	117		2,148
1988	119	462	45	77	150	191	423	309	250				2,026
1989							149	1,269	40	#	142		1,600
1990				77	356	441	721						1,596
1991	91	848	388										1,327
1992							202	853	83	23	39		1,199
1993				37	170	411	445						1,063
1994	48	684	359										1,091
1995		*					218	736	121	30	40		1,145
1996				88	150	400	377					25	1,038
1997	36	594	316										946
1998							254	598	96	31	34		1,013
1999				67	199	425	285					36	1,013
2000		659	354										1,013
1976 to 2000	438	4,278	2,179	601	1,249	3,068	3,655	5,781	1,219	279	414	61	23,223

* less than 0.5 t.

# Data does not meet confidentiality requirements.

Table 2.1.6. Summary of geoduck landings (tonnes) by South Coast Management Area in 2000, as reported on validation logs.

	SOUTH COAST MANAGEMENT AREAS																	
	East Coast V.I.											West Coast V.I.							Monthly
Month	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	Totals
Jan				27.5											141.3				168.7
Feb				#											78.1				79.8
Mar			30.9						#							#			33.8
Apr			7.9		10.5										26.8	19.3			64.6
May					7.0				14.8						35.6				57.4
June									9.7						45.8				55.5
July					34.3				12.8						10.7	11.1			68.9
Aug			7.3		61.8	1.5										44.3			115.0
Sept				41.9	10.2	#									8.6	7.0			#
Oct				10.3															10.3
Nov								#							9.4				#
Dec															49.0				49.0
Area Totals			46.1	#	123.8	#		#	37.3						405.3	#			784.0

Mainland and East Coast Vancouver Is.: 294.0 **West Coast Vancouver Is.: 489.9**

South Coast Total: 784

# Data confidential

Table 2.1.7. Summary of geoduck landings (tonnes) by North Coast Management Area in 2000, as reported on validation logs. Values in lbs.

Month	NORTH COAST MANAGEMENT AREAS												Monthly Totals
	1	2E	2W	3	4	5	6	7	8	9	10	106	
Jan		84.7											84.7
Feb		113.0											113.0
Mar		123.8											123.8
Apr		80.2											80.2
May		32.5	34.6										67.0
June			63.8										63.8
July			#										#
Aug			#										#
Sept			42.5										42.5
Oct		1.5	109.5										111.0
Nov		23.0	79.5										102.5
Dec		200.1											200.1
Area Totals		658.6	354.1										1012.7

Data confidential

Table 2.1.8. Summary of 2000 "G" licence quota overages for all geoduck licence areas.

Licence Area	No. "G" licences	No. licences over I.Q.	No. licences with overage 1 - 200 lb.	No. licences with overage > 200 lb.	Licence area remaining quotas	
					(lb.)	% over/under
SOUTH COAST						
Inside Waters	9	2	2	0	-219	0.03
West Coast Vancouver Island	15	3	3	0	-62	0.01
NORTH COAST						
Queen Charlottes	31	3	1	2	-698	0.03
COASTWIDE TOTAL	55	8	6	2	-979	0.02

Table 2.1.9. Number of 2000 "G" licences, number of fishing vessels, licence area quotas and landings for each geoduck licence area.

Licence Area	Statistical Areas Open	No. Licences	No. Vessels	Licence Area Quota (lb)	Total Landings (lb)
SOUTH COAST					
Inside Waters [1]	portions of Areas 13, 14, 15, 16, 18 & 19	9	9	648,000	648,219
West Coast Vanvouver Isl.	portions of Areas 24 & 25	15	13	1,080,000	1,080,062
	Total			1,728,000	1,728,281
NORTH COAST					
Queen Charlottes	portions of Areas 1 & 2	31	24	2,232,000	2,232,698
COASTWIDE TOTAL		55	42 [2]	3,960,000	3,960,979

[1] Includes purge fishing at south Savary Island (Area 15) and Crescent Bay (Area 16).

[2] The sum of the number of vessels fishing in each licence area is greater than the total number of vessels that fished coastwide because a number of vessels fished in more that one licence area.

Table 2.1.10. Geoduck bed closures (temporary and permanent) to 2000.

Stat Area	Sub Area	Bed Code	Description	Bed Area (ha)	Estimated Density (#/m2)	Estimated Biomass (lb)	Reason for Closure
North Coast							
1	2	3	DADENS	2	1.35	66,287	Contaminated
1	2	4	LANGARA/PARRY PASSAGE	1	1.35	25,416	Contaminated
1	2	5	CLOAK BAY	1	1.35	24,042	Contaminated
2	1	1	SKIDIGATE MISSION	81	1.35	3,027,288	First Nations
2	1	4	ROBBER ISLAND	2	1.35	59,000	Contaminated
2	1	5	TRANSIT ISLAND	3	1.35	125,095	Contaminated
2	1	6	ONWARD POINT	6	1.35	229,651	Contaminated
2	13	3	N OF DOLOMITE NARROWS	2	1.35	89,679	Park
2	16	1	S OF DOLOMITE NARROWS	19	1.35	697,169	Park
			Total North Coast	**117**			
Inside Waters							
12	16	3	HARDY BAY SE DUVAL IS	7	1.35	244,279	Contaminated
12	16	11	BEAVER HBR	44	1.68	1,948,571	Contaminated
12	16	13	E THOMAS PT - AIRPORT	20	1.68	697,895	First Nations
13	3	1	GOWLAND HBR - MAY IS	4	0.7	64,672	Marine Park
13	3	2	S GOWLLAND IS	2	0.7	38,731	Marine Park
13	13	1	DREW HARBOUR	23	0.7	415,811	Contaminated
13	15	1	N MARINA IS	81	0.7	1,430,083	DFO Research
13	15	2	S MARINA IS	235	0.45	2,569,317	DFO Research
13	15	6	MANSONS LANDING	29	0.7	491,775	Contaminated
14	8	1	DEEP BAY	12	0.7	227,937	Contaminated
14	8	2	MUD BAY	9	0.7	158,589	Contaminated
14	8	4	SHIPS PT	16	0.7	305,466	Contaminated
14	11	2	UNION POINT	15	0.7	386,556	Contaminated
14	11	4	GARTLEY POINT	16	0.7	428,262	Contaminated
15	1	1	S WESTVIEW	53	0.7	870,391	Contaminated
15	3	8	MITTLENATCH IS	9	0.7	142,619	Marine Park
17	17	7	E MUDGE IS	90	0.7	1,128,104	DFO Research
19	8	1	PATRICIA BAY	104	0.7	1,313,171	Contaminated
19	8	2	COLES BAY	17	0.7	214,694	Contaminated
29	5	4	CORDERO PT	3	0.7	41,822	Marine Protected Area
			Total Inside Waters	**789**			
23	5	13	SW FLEMING	8	1.7	303,688	Bamfield Marine Stn
23	5	14	MID W. SHORE FLEMING IS	8	1.7	286,167	Bamfield Marine Stn
23	8	6	S BRABANT - N PEACOCK CH	6	1.7	408,663	Bamfield Marine Stn
23	8	7	NE CLARKE IS	6	1.7	420,987	Bamfield Marine Stn
23	8	8	E TURRET IS	3	1.7	209,521	Bamfield Marine Stn
23	11	4	UCLUELET HBR ENTRANCE	1	1.7	18,739	Contaminated
24	1	2	HESQUIAT HBR	10	1.8	423,451	First Nations
24	6	6	WHITESAND COVE	13	2.16	748,300	Marine Park
24	6	18	AHOUS BAY	3	2.16	118,611	Whale Sanctuary
24	6	30	S OF ROBERT PT	8	2.16	430,068	DFO Research
24	6	31	DUNLAP IS	12	2.27	664,154	DFO Research
24	7	5	N RICHIE BAY	1	2.16	70,361	DFO Research
24	9	1	VAN NEVEL CHNL	39	1.7	1,313,352	Contaminated
24	9	2	TOFINO	6	1.7	217,144	Contaminated
26	6	5	SOUTH WALTERS IS	4	1.99	184,143	Contaminated
26	6	9	INSIDE ROLSTON IS	3	1.99	111,899	Contaminated
26	7	1	N OF CHECKAKLIS IS BUNSBY'S	34	1.7	1,259,595	Sea Otter Reserve
26	7	2	BATTLE BAY - NW OF BUNSBY IS	6	1.7	233,584	Sea Otter Reserve
26	7	3	SW OF THEODORE PT	5	1.7	187,258	Sea Otter Reserve
26	7	4	ACOUS PENN - CUTTLE ISLAND	12	1.7	473,200	Sea Otter Reserve
26	7	5	WEST OF BATTLE BAY	3	1.7	126,760	Sea Otter Reserve
26	10	2	SW NASPARTI INLET	12	1.7	477,421	Sea Otter Reserve
26	10	3	NORTH OF CAMEL IS	14	1.7	561,052	Sea Otter Reserve
26	10	4	NASPARTI INLET WEST	9	1.7	377,719	Sea Otter Reserve
26	10	5	NASPARTI INLET EAST	18	1.7	717,779	Sea Otter Reserve
26	10	8	NW JACKOBSON PT	5	1.7	208,915	Sea Otter Reserve
26	10	9	ACOUS PENN NORTH	14	1.7	572,069	Sea Otter Reserve
			Total WCVI	**263**			
			Total Closed Area	**906**			

Table 2.1.11. Summary of 2000 geoduck observer fisheries (biosamples, bed verification and market samples).

Location	Dates	Duration of Monitoring (days)	Mgmt/Sub Areas (GMA)	Vessels Participating	Scheduled Activities [1]	Observer(s)	Comments
NORTH COAST							
Ramsay Island	Dec. 28	1	2-11 (QCF2)	Gambier Paul Anthony Paula G	MS	Doug Stewart	
Deluge Point	Nov. 28	1	2-15 (QCF8)	Triton J Paul Anthony Paula G	MS	Doug Stewart	
Luxana Bay	Apr. 11	1	2-19 (QCB11)	Ocean Ltd. Charlie Skiff,AquaStar, Taiofa	MS BV	Doug Stewart	
Howe Bay	Apr.12	1	2-19 (QCB13)	Ocean Ltd. Charlie Skiff Northern Ocean Aquastar	MS,BV BV	John Leakey/ Doug Stewart	
Wells Cove	June 14	1	2-38 (QCC8)	Hideaway II, Aquastar	MS	John Leakey	
Gowgaia Bay	June 17	1	2-38 (QCC7)	Hideaway II	BS	John Leakey/ Doug Stewart	
Mike Inlet	June 24	1	2-38 (QCC9)	Hideaway II, Nova Star	MS	John Leakey	
Pocket Inlet	June 28	1	2-38 (QCC11)	Hideaway II	MS	John Leakey	
Barry Inlet	June 18	1	2-42 (QCC10)	Hideaway II, Aquastar	MS	John Leakey	
Lomgon Bay	Sept. 26	1	2-42 (QCC12)	Deep Six, Chiboum	MS	John Leakey	
Tasu Inlet East	Sept. 25	1	2-42 (QCC12/C13)	Charlie Skiff	MS	John Leakey	
Newcombe Inlet	Sept. 29	1	2-43 (QCC14)	Fraser Sunrise	MS	John Leakey	
Lomgon Bay/East of Tasu Narrows	Sept. 26		2-42 (QCC12/C13)	Deep Six	BS	John Leakey	
Two Mountain Bay	Sept 29	1	2-45 (QCC15)	Deep Six	BS	Doug Stewart	
	Sept. 30	1	2-45	Charlie Skiff	MS	John Leakey	
Carew Bay, within Kanu Inlet	Nov. 18	1	2-71 (QCD7)	Triton J Paula G Paul Anthony	MS	Doug Stewart	
Lauder Island	Nov. 10	1	2-82 (QCD10)	Jolly Dog All Seasons	MS	Doug Stewart	
Hippa Is.	Oct. 31	1	2-87 (QCD11)	Deep Six	BS	John Leakey/ Doug Stewart	445 pcs. 431 pcs condition 1
WEST COAST OF VANCOUVER ISLAND							
Nutchatlitz	Sept. 14,15	2	25-14 (25B)	White Rock, Aaran Tide	BV	M. Walker	
Bartlett Island	May 9,10	2	24-6 (24B1a)	White Pointer, Lynn Marie	BV	M. Walker	
INSIDE WATERS							
No monitored fishing opportunities for the inside waters.							

[1] Activity codes: BC - boundary compliance, BV - bed verification, EXP - exploratory fishery, MS - market sample.

Table 2.1.12. Summary of 200 geoduck assessment surveys with DFO/ UHA/ First Nations.

Survey Area	Vessel	Management Area	Biosample Harvest Date	Native Band/ Third Party	UHA Biologist Present
North Coast	n/a	n/a	n/a	n/a	n/a
QCI					
Hippa Island	Deep Six	2-87	Oct. 31	none	N
Tasu Sound	Charlie Skiff and Deep Six	2-42, 45	Sept. 29	none	N
Gowgaia Bay	Hideaway II	2-38, -39, -40	Jun-16	none	N
Central Coast					
Scouting to Expand Bed Area	Jolly Dog	7, 8 & 9	none	none	Y
West Coast					
Maggie River / Toquart Bay, Barkley Sound	Full Nelson	23-10	June 3	contract / DFO	Y
Nootka Sound	Full Nelson	25-6, -15	Sept. 2	contract	Y
Ritchie Bay, Clayoquot Sound	Full Nelson	24-7	July 11-16	DFO	Y
Inside Waters					
Round Island	Ten Forward	17-16	May 9	contract / DFO	Y
East Valdes Island	Ten Forward	29-5	none	contract / DFO	Y

Table 2.1.13. Summary of 2000 activities for DFO/ UHA long term geoduck research projects.

Location	Research Project Focus	Dates	Vessel	Status	1999 Activities
Ritchie Bay	Harvest Manipulation, Density, Growth, Survival, Recruitment, Enhancement	July 7-17, 2000	Full Nelson, DFO skiff		Maintenance, Density, Biosample & Venturi Sample for Bivalve Diversity
Gabriola Island	Harvest Manipulation, Density, Growth, Survival, Recruitment, Enhancement	Apr. 25 & 28, 2000	Ten Forward	maintenance	Maintenance
Marina Island	Harvest Manipulation, Density, Growth, Survival, Recruitment, Enhancement	Oct. 4	UHA Seeding boat	maintenance	Maintenance

Table 2.1.14. Summary of 2000 geoduck purge fishing harvest from aquaculture lease sites.

Aquaculture Site Location	Management Area	Dates	No. Vessels	Landings (lb.)
North Savary Island	15-2	No fishing in 2000	0	0
South Savary Island	15-2	July 21- 23; Aug. 27; Sep 2-4	8	22,021
South East Marina Island	13-15	No fishing in 2000	0	0
South West Marina Island	13-15	No fishing in 2000	0	0
Crescent Bay, Texada Island	16-22	Aug 19, 20; Sept. 6	4	6,097
		Total Purge Fishery Landings [1]		28,118

[1] 2000 purge fishing landings were deducted from the Inside Waters GMAs in Management Areas 18.

Table 2.1.15. Geoduck purge fishing landings from aquaculture lease sites, 1995 to 2000.

Aquaculture Site	1995 Landings (lb.)	1996 Landings (lb.)	1997 Landings (lb.)	1998 Landings (lb.)	1999 Landings (lb.)	2000 Landings (lb)	Total Landings by Site [2] (lb.)
S.W. Marina Island [1]	20,679	0	155	0	396	0	30,815
S.E. Marina Island [1]		0	3,673	0	5,912	0	——
North Savary Island	0	34,068	21,843	20,261	303	0	76,475
South Savary Island	0	59,674	105,502	10,642	52,231	22,021	250,070
Texada Island	7,327	25,522	11,592	8,347	9,361	6,097	68,246
Annual Total Landings	28,006	119,264	142,765	39,250	68,203	28,118	425,606

[1] S.W. and S.E. Marina Island landings are grouped for 1995

[2] Total S.W. and S.E. Marina Island landings are combined

Table 2.1.16. Summary of 2000 geoduck fishery incident reports.

	Low Priority			Medium Priority			High Priority			
Port / Area	Contamination of Geoducks on packer	No PSP record completed for sample	Fishing in area without observer	Geoduck cages lost overboard	Geoduck cages spilled in packer hold	Scale problems	Fishing in a closed area	Report of unvalidated geoduck landing	No. of cages offloaded from packer not consistent with dock/VCR plant observations	Total Reports
Port Hardy	1				2				3	6
Powell River						1		1		2
Tofino/GMA "Outside"							1			1
Zeballos		1								1
Prince Rupert				1	1				1	3
Queen Charlotte Is.			1							1
Total	1	1	1	1	3	1	1	1	4	13

2.2. Horse Clams – S. Heizer

2.2.1. Introduction

Harvesting horse clams is done through a limited entry fishery, available to the 55 holders of G licenses. G license holders may harvest horse clams and geoducks. Landings have been recorded since 1979.

Two species of horse clams are taken: *Tresus capax* and *T. nuttallii.*

The lack of markets for the processed necks and body meat has limited landings in this fishery. Since 1992, managers have restricted development of this fishery until appropriate stock assessments have been done. There is currently no market for live horse clams.

2.2.1.1. Participants

The commercial fishery operates under license limitation: There are 55 commercial geoduck licenses (referred to as "G-tabs") which were fished on 42 vessels in 2000. Not all of these licenses harvest horse clams: Less than half the fleet (19 vessels reported landings in 2000) typically participates in this fishery (Table 2.2.1).

The numbers of sport fishermen is unknown, but catches are considered to be marginal. First Nation's participation in the fishery is currently limited to catches for food, social and ceremonial purposes, and is of unknown magnitude.

2.2.1.2. Location

Commercial harvest of horse clams is limited to subtidal areas 10 feet (3.05 m) below chart datum. The extent of horse clam beds in British Columbia is unknown, but horse clams are encountered in or near many geoduck beds, and a potential for harvest of horse clams exists for each area open.

2.2.1.3. Time Frame

The license year is from January 1 to December 31 in each year. The location and schedule of geoduck openings and closings varies from year to year, but the potential to harvest is available for every day of a calendar year. The potential timing of horse clam landings is identical to that of geoducks.

2.2.1.4. Landings/ Value/ Markets

Table 2.2.1 presents a summary of landings from 1979 to 2000. The effort (estimated at 242 boat days) and landings of 28,499 lb (12.9 t), in 2000, were greater than those in 1999 (155 boat days and 10,329 lb or 4.7 t). The record low landings, in 1996, were 24 lb (0.01 t). The majority of 2000 landings (19,116 lb or 8.67 t.) were from Area 2 (Table 2.2.2). A smaller amount (558 lb or 0.25 t.) was landed from Area 24 (Clayoquot Sound) and 8,828 lb (4.0 t.) were landed from Areas 13, 14, 15 and 19 on the East Coast of Vancouver Island (Table 2.2.2). The price averaged $2.10 per kg ($0.95 per lb).

The increase in landings in 2000 may be a result of fishers thinking that landings reported will enhance their entitlement to horse clams if there is an adjustment to the allocation of licenses.

2.2.1.5. Consultative Process

Consultation in this fishery occurs coincidentally with consultation in the geoduck fishery. The primary consultation is with the Sectoral Committee which includes representatives from DFO, the Canadian Food Inspection Agency, Environment Canada, the Provincial Ministry of Fisheries, licence holders, First Nations and sport fishing interests. There are at least two meetings a year, often more. At the first meeting, the wishes and comments from all sectors are solicited for consideration in drafting the fishing plan.

A draft fishing plan is distributed to all sectors in August. At a second meeting, the draft fishing plan is subject to comment from all sectors. These comments are considered in the drafting of the final plan.

As well as the previously mentioned scheduled consultations, there are many ad hoc consultations during the year with First Nations groups, Area Representatives of the license holders (there are three: North Coast, West Coast Vancouver Island and Inside Waters), other government agencies and other interest groups.

2.2.1.6. Management Styles

The fishery is managed by limiting harvest to an incidental (non-directed) catch occurring in the process of the geoduck fishery: A directed fishery is proscribed. There are, as well, ceilings or catch limits imposed for South Coast areas. If catches of horse clams appear to be going to exceed these ceilings, the fishery for geoducks and horse clams is closed until fishermen agree to avoid harvesting horse clams.

The catch ceilings are loosely scaled to historical catches.

A third party validation company, paid for by the harvesters association (the Underwater Harvesters Association or UHA), verifies all landings.

2.2.2. Stock Status

2.2.2.1. Biology

T. capax is found in the eastern Pacific from Kodiak Island in Alaska south to Monterey, California. *T. nuttallii* is found in the north Pacific. In the northeast Pacific, T nuttallii ranges from southeast Alaska to Baja California.

T. capax is found from the mid- and low-intertidal to subtidal depths to 30 m and in a variety of substrates including mud-shell-gravel, pea gravel, gravel and shell, sand, silty sand and fine sandy mud. *T. nuttallii* is found from the low-intertidal to subtidal depths to 50 m, commonly in fine sand or firm sandy mud substrates, but also in stiff clay and mud with gravel.

T. capax commonly occurs with littleneck and butter clams in the intertidal, and often with *T. nuttallii* where the ranges overlap. *T. nuttallii* occurs with littleneck and butter clams and with *T. capax* in the intertidal, and with geoducks (*Panopea abrupta*) in subtidal areas.

Sexual maturity occurs at shell length of 70 mm for both species, when *T. capax* will be 3 to 4 years old, and *T. nuttallii* will be 3 years old. Maximum age of *T. capax* seen in BC is 18 years, at a shell length of 180 mm, and for *T. nuttallii*, maximum age is 22 years at a shell length of 220 mm.

Recruitment relationships are poorly understood.

2.2.2.2. Assessment

No new stock assessment activities took place in 2000. A paper evaluating stock dynamics of horse clams was presented to PSARC in June 2000.

2.2.2.3. Prospects

The fishery has been limited to an incidental fishery, open only when the geoduck fishery is open. Horse clams have been opened and closed concurrently with geoducks since 1992. This has reduced opportunities and landings in the fishery and is reflected in historical catches (Table 2.2.1.). Processors do not usually want horse clams when they are buying geoducks.

There is a small but growing interest in developing a directed fishery on horse clams. This interest is not reflected in the historical catches (Table 2.2.1.) since catch levels have been strongly curtailed by management actions rather than by interest in harvest or stock availability. Fishermen maintain that a certain level of harvest must occur before there is a market interest, and that the constraint of no directed fishery effectively precludes reaching this level.

Fishermen have been informed that before a directed fishery can be entertained, basic productivity parameters (recruitment, growth, densities and bed sizes) will have to be determined at the expense of the industry. As well, there is some concern that fishermen may harvest in eelgrass beds (either in violation of the harvest depth restriction or in beds which are deeper than 10 feet below chart datum): This concern will have to be addressed in advance of any directed fishery. To date, these concerns have acted as a deterrent to the development of this fishery.

Horse clams are taken incidentally to butter clam harvesting, in the intertidal zone, and are generally discarded where they have been taken. If a directed horse clam fishery prosecuted under authority of a G license is allowed, licensing (or other control) of the incidental harvest of horse clams in the butter clam fishery will have to be addressed.

2.2.3. Current Management Issues

There continues to be concern about the impact of harvesting horse clams in eelgrass beds. In many areas, horse clams are in the intertidal zone or shallow subtidal zone. The G license restricts harvest to depths greater than 10 feet (3.05 m) below chart datum.

2.2.4. Long Term Objectives for the Fishery

There are objectives for this fishery which are shared by all others: These are to understand oceans and aquatic resources, to manage and protect the fisheries resource, to maintain and protect the marine and freshwater environment, to maintain maritime safety, and to facilitate maritime trade, commerce and ocean development.

2.2.5. Specific Management Objectives

2.2.5.1. Conservation/ Sustainability

The biological objective of this fishery is to limit the fishery until there is adequate stock assessment information for a directed fishery. The management objectives are to accomplish this objective by limiting the fishery to a harvest incidental to geoducks. This is accomplished by limiting harvest to those areas and times of geoduck openings, by setting several catch ceilings and by requiring landings to be validated.

Other objectives are to limit the fishery to the subtidal area (10 feet (3.05 m) below chart datum), to protect intertidal vegetation and habitats supporting herring spawn and to monitor size of clams to determine if significant declines in mean size occur (which would require consideration of effort restrictions).

2.2.5.2. Domestic Considerations

Aboriginal Fisheries

First Nations claim to have traditionally harvested horse clams, and have expressed an interest in the development of this fishery. Any development of this fishery will take into account First Nation's interests

Commercial Fishery

The explicit objective of the Plan is to hold the fishery in check until basic population parameters are known

Experimental Fishery

Industry continues to request exploratory fisheries. A Phase 0 assessment was presented to PSARC in 1998 to begin to address these requests. The Department has made it clear that exploratory fisheries will occur only after typical beds are surveyed so that basic population parameters can be estimated for use in determining an appropriate Total Allowable Catch (TAC).

2.2.6. Fishery Management Measures

2.2.6.1. Fishing Season

Management restrictions for this fishery limit the fishery to those areas open to geoducks. This had allowed for fishing in an area once every three years, with the exception of Area 24 which was open every year with a precautionary harvest limit of 11,025 lb (5 t). More areas are being opened on an annual basis (no rotation) such as Area 19 and the whole of the West Coast of Vancouver Island (Areas 23 through 27).

Control and Monitoring of Fishing Activities

All horse clams landed must be validated by a third-party validation company, the same one as used by geoduck fishermen. The G license requires submission of harvest log data to document catch and effort in the fishery.

2.2.7. Other Relevant Elements

2.2.7.1. Licensing

The coast is divided into 3 license areas, the north coast, the west coast of Vancouver Island, and waters inside Vancouver Island. The number of licences fishing each area may change annually according to the proportion of the total quota assigned to each area. Movement of licences has little to do with issues involving horse clam harvesting.

2.2.7.2. Conservation and Harvesting Techniques

Catch ceilings have been imposed on Inside Waters and the west coast of Vancouver Island. Area 12 is limited to 2,205 lbs (1 t), Area 13 to 2,205 lbs (1 t), Area 14 to 4,405 lbs (2 t), Area 15 to 11,025 lbs (5 t), Area 16 to 4405 lbs (2 t), Area 17 to 2,205 lbs. (1 t), Area 18 to 4,405 lbs (2 t), Area 19 to 2,205 lbs (1 t), Area 23 to 2,205 lbs. (1 t), Area 24 to 11,025 lbs. (5 t) Area 25 to 4,405 lbs (2 t), Area 26 to 2,205 lbs (1 t) and Area 27 to 2,205 lbs. (1 t). These amounts are loosely based on historical catches: Areas with high catches were limited to 11,025 lbs (5 t), areas with moderate catches to 4,410 lbs (2 t), and areas with low catches to 2,205 lbs (1 t). The North Coast harvest is not limited by catch ceilings.

2.2.7.3. Enforcement Issues and Strategies

Harvesting horse clams during closed periods or by unlicensed operators (poaching) is the main concern for enforcement personnel.

There have been some recent arrests of people harvesting horse clams in Boundary Bay by cutting off necks and discarding the rest of the animals. These individuals have been claiming to harvest recreationally, but have been exceeding recreational harvest limits. There is evidence that these clams are being sold in local markets.

2.2.8. Financial Responsibilities

2.2.8.1. Industry

The Underwater Harvesters Association (UHA) contributes to a water quality and shoreline assessment program carried out by D.O.E. and to a coastwide PSP sampling program. They also offset the salary of one full-time management biologist for Fisheries and Oceans.

2.2.8.2. DFO

Fisheries and Oceans Canada provides, in support of this fishery, stock assessment, management of the fishery and enforcement activities.

Table 2.2.1. Horse clam landings (tonnes) and effort for British Columbia, 1979 to 2000, as reported on sales slips and harvest logs.

Year	Licences Issued	Vessels with Landings	Fishing Days	Total Landings (t)	Total Landings (lb)	Total Value ($·10³)	Mean Price ($/t)	Mean Price ($/lb)
1979	G 101	N/A	N/A	37.0	81,585	N/A	N/A	N/A
1980	G 95	28	N/A	128.0	282,240	79	617	0.28
1981	G 52	12	N/A	51.0	112,455	38	750	0.34
1982	G 52	40	N/A	321.0	707,805	235	728	0.33
1983	G 54	8	N/A	21.0	46,305	12	573	0.26
1984	G 54	5	N/A	6.7	14,774	6	816	0.37
1985	G 55	7	N/A	6.3	13,892	6	926	0.42
1986	G 55	15	193	96.0	211,680	63	661	0.30
1987	G 55	27	471	355.0	782,775	359	1014	0.46
1988	G 55	33	405	325.0	716,625	300	926	0.42
1989	G 55	16	118	116.0	255,780	144	1235	0.56
1990	G 55	22	254	124.0	273,420	138	1102	0.50
1991	G 55	17	183	110.0	242,550	119	1080	0.49
1992	G 55	2	8	1.7	3,826	2	1080	0.49
1993	G 55	17	118	23.2	51,081	49	2116	0.96
1994[2]	G 55	5	105	58.9	129,824	111	1742	0.86
1995[2]	G 55	8	15	1.3	2,907	3	1000	0.96
1996[2]	G 55	1	1	0.0	24	ND	ND	ND
1997[2]	G 55	12	142	7.5	16,426	13	1931	0.88
1998[2]	G 55	6	33	0.8	1,843	2	1764	0.80
1999[2]	G 55	18	155	4.7	10,329	9	2063	0.94
2000[2]	G 55	19	242	12.9	28,499	30	2101	0.95
Totals				1,795	3,958,145	1,687		

N/A - data not available ND - no data

[1] from sales slip data

[2] data from harvest logs, harvest log data for 1994 to 1999 reviewed and modified in 2000

Table 2.2.2. Summary of horse clam landings (tonnes) by management area from North Coast and South Coast areas, 1979 to 2000, as reported on sales slips or harvest logs.

HORSE CLAM LANDINGS BY MANAGEMENT AREA (tonnes)

	North Coast									Inside Waters										West Coast V.I.							
Year	1	2	4	5	6	7	8	106	Total N.C.	12	13	14	15	16	17	18	19	29	Total Inside	20	23	24	25	26	27	Total W.C.	Total Coastwide
1979											#	27.0	0.3	6.5	0.2				34.0				4.3			4.3	38.3
1980										0.1	0.5	22.0	46.0	50.0	9.0		#		127.6		0.4		#	#		0.4	128.0
1981										5.2	#	7.3	1.4	1.7	4.2		2.3		22.1		1.2	27.1	0.7			29.0	51.1
1982										3.1	0.3	163.0	0.3	2.6	14.8				184.1		2.3	123.6	3.4	6.6		135.9	320.0
1983												0.2		#					0.2		#	4.5	#	15.7		20.4	20.6
1984											3.9	2.3	#						6.2								6.2
1985												6.0		#	#				6.1					#		#	6.1
1986											#	67.0	0.9	#	2.0	3.0			96.1		#	#	#			0.4	96.5
1987		#		#					0.2	24.0	0.5	132.0	42.0	5.9	146.0	#	#	3.4	354.2	0.1	#	#				1.3	355.7
1988		0.7	#	0.1					0.8		14.4	57.7	0.3	9.2	77.1	#	#	5.3	170.4		7.3	140.7	#	4.2	#	154.3	325.5
1989						#			0.1	22.5	#	#		#	#		#		32.5		4.8	78.1			#	83.0	115.6
1990												29.0		6.0		#			35.0			90.0				90.0	125.0
1991			#						1.0				6.0		22.0				28.0			78.0	2.0			80.0	109.0
1992						#	#		2.0	#									0.2								2.2
1993												6.7		#					8.2			14.1			#	15.0	23.2
1994		4.2							4.2				57.5		1.9				59.4				0.1			0.1	63.7
1995					#	#	#		0.1			1.1							1.1			#				#	1.3
1996					#				#																		0.0
1997	#	7.2							7.3				#						#								7.5
1998					#	#			0.0												#	0.8				0.8	0.8
1999			#	#	0.9			0.2	1.3		#	1.8	#	#					2.5			0.9				0.9	4.7
2000		8.7							8.7		#	2.7	#				#		4.0			0.3				0.3	12.9
Area Totals	0.1	12.3	1.1	0.2	0.9	1.1	1.1	0.2	17	55.1	44.3	523.3	155.0	84.4	285.2	8.2	3.9	8.7	1,168	0.1	16.4	559.1	11.6	26.5	2.2	616	1,801

Data for 1979 to 1993 obtained from DFO records.
Data for 1994 to 2000 landings obtained from validation records and harvest logs.
# Data is confidential

2.3. Scallop Experimental Fishery – E. Wylie

2.3.1. Introduction

This report presents an overview of the 2000 experimental scallop fishery, summarizing gear types, dive and trawl. The recreational and aboriginal effort for scallops is low and therefore, no information is available for this update on the harvest characteristics of these sectors. This scallop update includes detailed landing data from the 2000 season, which ran from January 2000 to December 2000, and annual historic commercial data.

2.3.2. Overview of the Commercial Fishery 1982-1999

The commercial fishery for pink and spiny scallops began in 1982, when a Z-I category licence was required to harvest pink and spiny scallops by either dive or trawl gear. Starting in 1993, a separate licence category (Z-R) was established for fishing with trawl gear. There was no limit to the number of licences issued in either the dive or trawl fishery. There was also no limit to the Total Allowable Catch (TAC). The commercial fishery was managed primarily by a size limit of 55mm for both species. The fishery only occurs in the southern coast of British Columbia due to limited biotoxin testing in the north.

In 1999 the Scallop Dive and Trawl commercial fisheries were suspended. It was determined that there was insufficient information about the distribution and biomass of scallop stocks to ensure conservation of the resource and sustainability of the fisheries. An experimental fishery for both the trawl and dive fishery was initiated in 2000.

Within the Stock Assessment Division of DFO, a framework was developed for the provision of scientific advice for the management of new and developing invertebrate fisheries, including established fisheries whose expansion is limited due to a lack of information of the species distribution or abundance (Perry *et al.* 1998). This framework included three phases for the precautionary development of a fishery:

> Phase 0: Collection of all available information on the target species, and from similar species elsewhere, to provide a baseline with which to advise on the alternative management options and to identify areas where information is lacking;
> Phase 1: Involves surveys and experimental fishing where the objective is the collection of data required to fill in the information gaps identified in the first phase and to explore the fishery potential.
> Phase 2: Fishing for Commerce. A fishery is developed at the commercial level, while stocks are monitored and management strategies are evaluated.

These two species were being passively managed as one species, one stock. This fishery has been prosecuted for the last 16 years, and yet there has never been a comprehensive assessment. There is a need to collect and analyze appropriate and sufficient biological information to ensure sustainability of the stocks with acceptable harvest practices and harvest levels. An understanding of the productivity characteristics of each species is required, and whether they are sufficiently unique as to require separate assessments and management measures. An understanding of stock distribution and delineation is required. There is anecdotal information on possible over-fishing in some areas, yet it is not known whether there are unique populations, discrete stocks in each area, or a series of metapopulations distributed throughout the fishing areas (Lauzier *et al.* 2000).

2.3.3. Participants

In 2000, experimental licences were unlimited but fishermen interested in participating in the experimental fishery had to commit to biological sampling and increased reporting, as detailed in the experimental guidelines. There were twelve experimental dive licences issued, and ten of these licence holders recorded landings (Table 2.3.1). Two experimental trawl licences were issued in 2000, but no harvest occurred. First Nations did not hold any commercial scallop licences but are permitted to harvest scallop for food, social and ceremonial (FSC) needs. Effort in the FSC fishery is considered to be low.

A Tidal Water Sport Fishing Licence is required for the recreational harvest of scallops. The daily maximum sport limit for spiny and pink scallops is 75 animals, with a possession limit of 150. The sport limit for rock and weathervane scallop is six animals per day and a possession limit of twelve. Effort in this recreational fishery is thought to be very low.

2.3.4. Location of the fishery

2.3.4.1. Dive Fishery

A relatively small portion of the south coast, mainly the Strait of Georgia, (Table 2.3.2), has supported much of the dive fishery from at least the mid 1980's when harvest logs (as a reporting requirement) were first introduced into the scallop fishery.

In 2000, areas 13 through 20 were open to the experimental fishery subject to PSP closures. The majority of the dive catch, 57%, came out of area 14. This contrasts historical landing patterns. As much as 89% of the historic catch has come from areas 17, 18 and 29 (Table 2.3.2) in some years. It is unsure whether this shift in landings comes from lack of stock, PSP closures or the fact that the most productive fishermen reside in that area and now concentrate their fishing efforts there. The Subarea 29-5 was closed in 1998 due to concerns of over-harvesting and would have contributed to the shift in fishing locations.

2.3.4.2. Trawl Fishery

In 2000 no harvest, by the trawl fleet, occurred. The few that were involved concentrated their efforts on biomass surveys, bycatch and trawl efficiency studies. Harvest will take place in 2001. In 1999, landings were minor and only three vessels participated. Catch by trawl operations came from Areas 13 and 14. The trawl landings of 2.2 t in 1999 were the lowest on record since 1987.

The trawl fishery was limited in areas in 1993. At the request of dive harvesters, closures to trawl gear were set in 1993 in Subareas 17-10, 29-4, 29-5, 18-1, 19-5 and 19-6. These were areas most frequently harvested by dive fishers, who are thought to have the ability to harvest more selectively, with less undersize mortality and no physical disruption to the grounds. Although the studies that have occurred in 2000 have indicated that concerns for selectivity and environmental damage are somewhat unfounded.

2.3.5. Time frame

For both Dive and Trawl the fishing year is January through December. The fishery remained open year round for the dive fishery and would be opened for the trawl fishery in areas that had been surveyed and a Total Allowable Catch was determined. Consistent with earlier years, landings occurred throughout the year to provide a constant supply of scallops to a relatively small market (Table 2.3.3.).

2.3.6. Landings/Value/Markets

Pink and spiny scallops are locally marketed whole in the shell, fresh or frozen. Scallops are often served whole, in the shell, or on occasion, the large adductor muscle is selected. Scallops are susceptible to contamination from both biotoxins (e.g. Paralytic Shellfish Poisoning or PSP) and faecal coliforms. Scallops must be harvested from approved shellfish growing waters and must be landed at a registered shellfish plant prior to marketing according to the Department of Fisheries and Oceans (DFO) regulations.

The highest total annual landing recorded to date was in 1996, at 109 t (slips), 102 t (logs), Table 2.3.1. The average yearly landing of scallops is 71 tonnes from logbook data since 1990. Divers harvested 52 t in 2000 compared to 39 t in 1999 (Table 2.3.1). These dive landings were reported from ten licence holders. The total landed value increased from $211,000 in 1999 to $315,000 in 2000, and the whole landed value per tonne increased from $5735 to $5999/tonne. There were no scallops harvested by trawl gear in 2000.

2.3.7. Management styles

A minimum size limit was set initially in 1982 at 60mm shell height for pink and spiny scallops. After continued requests from fishers, and a limited survey and market sampling, the minimum size limit was reduced to 55mm, in 1989, for *Chlamys* spp., measured through the longest diameter of the shell perpendicular to the hinge (Bourne and Harbo 1997).

There are numerous small closures in park and study areas (See the 2000 Dive experimental guidelines).

2.3.7.1. Dive

The fishery has been open year-round in approved shellfish growing waters areas and in areas that have acceptable biotoxin levels. In 2000, the experimental dive fishery continued with a minimum size limit of 55mm shell height and was essentially open all year round, with the exception of PSP closures, in areas 13 through 20.

2.3.7.2. Trawl

The experimental trawl fishery was conducted somewhat differently than the experimental dive fishery. There were concerns that the trawl fishery was not selective and that the trawl gear damaged the sea floor. As well the product must be sorted on deck and the mortality of released scallops was unknown. The fishery was set up to test these three concerns prior to establishing a biomass estimate from which a total allowable catch would be calculated. Therefore no harvest occurred in 2000.

The size of the trawl drags used for fishing scallops was historically limited to a maximum width of two meters and will continue to be limited in the experimental fishery.

The trawl fishery also had a size limit of 55mm. However it was agreed to reduce the size limit to 48mm when harvest occurs. This size still allows spawning opportunities for the scallops and the catch will be based on a TAC from a biomass estimate. Pink scallops tend to be smaller than spiny scallops but with the larger size limit they often can not be retained. This size limit is marketable and will reduce potential mortality of scallops by not having to release as much of the catch.

2.3.7.3. Control and Monitoring

Both the dive and trawl licensed harvesters were required by conditions of licence to submit harvest logbook data (documenting detailed catch and effort) and copies of fish slips (documenting sale or other disposal of scallop catch) to DFO.

2.3.7.4. Quota Allocations

There was no total allowable catch (TAC) set for the scallop dive fishery in 2000. The trawl fishermen will be doing surveys that will result in a TAC being allocated.

2.3.8. Consultative process

When the commercial fishery was re-established as an experimental fishery the scallop fishermen created two associations. The divers formed the Pacific Scallop Harvesters Association and the trawlers created The West Coast Scallop Harvesters Association. The Department has been consulting with these two groups, First Nations and other interested stakeholders on the management of the fisheries throughout the year. Fishery managers also receive comments from individuals, commercial and sport fisherman throughout the year.

2.3.9. Stock Status

2.3.9.1. Biology, Environment, Habitat

Two species of scallops, the spiny scallop (*Chlamys hastata*) and the pink scallop (*C. rubida*) are commercially harvested from inshore waters by divers and by small trawl nets. Both species can attain a maximum size of approximately 80mm shell height, although more recent information indicates that pink scallops grow more slowly and the average maximum size is smaller than the spiny scallop. Scallops occur in small beds scattered along the coast of British Columbia (Bourne and Harbo 1987). The depth distribution of the spiny scallop is from the intertidal zone to 160 m on firm rock or gravel bottom, while pink scallops occur from 1 m to 200 m on softer sand and mud bottom.

2.3.9.2. Assessment

The Shellfish Data Unit from the Pacific Biological Station continued to collect and process harvest logbook information for scallop fisheries in 2000. The Catch Statistics Unit of DFO in Vancouver process and maintain the fish slip databases.

Resource maps with 'bed codes' for scallop fishing areas reported on harvest logs were first developed in 1995. In order to undertake detailed analyses by bed, existing bed information would have to be verified and digitized, as well as historic logs examined and bed codes inserted where possible. Scallop bed verification is currently being processed to help develop assessment tools.

Collections of up to 1500 scallops were sampled for length, whole weight and age. Harvesters collected them from the following Subareas under scientific licence in 2000: 18-1 (dive), 29-5 (dive), 17-10 (dive), 14-13 (dive), 15-3 (dive) and 13-1 (trawl).

The Pacific Scallop Harvesters' Association secured funding from the PFAR (Pacific Fisheries Adjustment and Restructuring) for undertaking dive surveys. A dive survey protocol has been developed. The survey will be the start in determining biomass, recruitment rates and likely lead to the development of a sustainable exploitation rate.

Trawl

Selectivity, bycatch, habitat and mortality studies were conducted in 2000 as part of the requirement to attain a licence for harvest. As a result of the studies conducted it was determined that the innovative net design of the trawl fishermen only caught scallops and resulted in very little bottom damage. A trawl survey protocol was developed and tested in 2000. Surveys will continue in 2001 and biomass estimates will be used to calculate a Total Allowable Catch.

Dive

Guidelines and survey protocol were developed for the dive fishery. Dive survey protocols have been completed and surveys will occur in 2001 with intent to assess stocks and harvest levels in Subareas 18-1 and 29-5.

2.3.10. Current Management Issues 2000-2001

2.3.10.1. The 2000 Experimental Scallop Fishery

In 2000, the scallop fishery continued to be basically an unlimited entry fishery, meaning that anyone could obtain a licence if they could designate a commercial fishing vessel to fish for scallops. The only requirement for the dive licence was to be willing to participate in sampling and surveys.

The dive association has recommended that the experimental licences be limited. Eligibility criteria have been established for the issuance of dive scientific licences, in 2001, with input from stakeholders. In order to qualify for an experimental dive licence fishermen must have a landing history of 10,000 lbs. between 1995 and 1999 or 6,000 in any one of those years. This would limit the participants to approximately ten licences before inclusion of First Nation participation.

The trawl fishery was unlimited but interested fishermen had to use approved gear and conduct a biomass survey in order to be provided with a harvest opportunity. The minimum size limit will be reduced to 48mm when harvest occurs.

Trawl fishermen were also required to study the bycatch levels and gear efficiency. Preliminary results indicate that this gear type was very selective as little bycatch was observed.

2.3.10.2. 2001 Experimental Harvest and Assessment Program

The landings and fishery participation have declined since the mid 1990's, particularly with the dive fishery. In the last two years there has also been a shift in where these animals are harvested. This should be investigated to determine if these declines are from stock levels, markets, PSP closures or other factors.

Managers have concerns that there may be localized over-harvesting in some areas under the current level of effort and recommend that more detailed analyses, including analyses of catch over time from specific harvest sites be undertaken. Analyses of scallop samples collected in 2000 should also be examined (what is the relative strength of the legal and sub-legal sized scallops in these areas of concern compared to other areas?).

The divers have committed to do a survey in area 29-5 and to initiate surveys in other areas.

The trawlers have shown the gear is not a concern for bycatch or environmental damage. They will continue to do biomass surveys in order to provide harvesting opportunities.

2.3.11. Long Term Objectives for the Fishery

The scallop fishery has been passively managed since its inception in 1982 until 2000. There have been concerns expressed for the conservation of scallops and the sustainability of this fishery under the past strategies. A phased approach, as described in Perry (1998), has been initiated. The phase 0 paper (Lauzier and Parker 1999), a collection of existing information was presented to Pacific Science Advice Review Committee (PSARC) in June 1999. The phase 1 (Lauzier *et al.* 2000), a fishery framework, was presented to Pacific Science Advice Review Committee (PSARC) in June 2000.

Following the presentation of these papers, experimental guidelines for the harvest of pink and spiny scallops in 2000 and 2001 have been established with the following objectives:

1. To develop an understanding of the stock distribution and abundance of pink and spiny scallops and to establish scallop management and assessment units.
2. To collect biological information, including age, growth and mortality data, for use in the development of biologically based assessment and management frameworks for pink and spiny scallops.
3. To establish precautionary biological reference points and limits.
4. To develop a consultative process for experimental fishery guidelines for the scallop fishery.

2.3.12. Specific Management Objectives

2.3.12.1. Conservation/Sustainability

- At the request of dive harvesters, closures to trawl gear were set in 1993 in Subareas 17-10, 29-4, 29-5, 18-1, 19-5 and 19-6. These are areas most frequently harvested by dive fishers, who have the ability to harvest more selectively with less undersize mortality and no physical disruption to the grounds.
- At the start of the 1998 season, DFO closed Subarea 29-5 to all commercial scallop fishing following reports of over-harvesting by dive fishermen.
- Initiation of a biological sampling program with which to assess scallop populations was initiated in 2000 under the scientific licence.
- In addition to the objectives of the experimental guidelines, scallop refugia will be considered.

2.3.13. Enforcement Issues and Strategies

Enforcement concerns include harvest of undersized scallops, fishing in areas closed due to contamination or PSP, sales from other than a registered shellfish plant and dockside wet storage of catch.

2.3.14. Financial Responsibilities

2.3.14.1. Industry

Commercial fishermen are required to submit logbooks and the logbook data electronically. A service bureau provides keypunching services. Keypunching fees for both dive and trawl were $70.00, in 2000.

Fishermen also contribute to the biotoxin testing by collecting samples from one monitoring site in Active Pass.

Both the Dive and Trawl Associations secured funding for survey work from the PFAR program (Pacific Fisheries Adjustment and Restructuring). Each association was provided with $25,000. Some of the money will be spent in 2001. In addition the groups contributed with in-kind donations.

2.3.15. Research

Dr. Ian Whyte from the Pacific Biological Station has continued studies, on the retention and physiological effects of domoic acid in some British Columbia bivalves including scallops (Whyte 1996).

2.3.16. Performance Review

2.3.16.1. Annual (post-season) review

Scallop Fishery Updates are completed on an annual basis. DFO personnel involved with invertebrate fisheries, other invited federal and provincial guests get together two or three times annually as a group, known as the Shellfish Working Group (SWG), to discuss shellfish issues. This forum allows for a review and discussions of specific issues from the scallop fishery, as for all of the invertebrate fisheries.

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Table 2.3.1. Annual landings (tonnes), value and effort for pink and spiny scallops, 1982 to 2000, as reported on fish slips and harvest logs.

	Type and # of Licences Issued		**# of Vessels with Landings** From logs		**Coastwide Landings** From logs	**Dive Gear Landings** From logs	**Trawl Gear Landings** From logs	**Landed Value** From Slips/Logs	**Whole Landed Value** From Slips	**Total Fishing Hours** From logs		**CPUE (kg/hr)** From Logs	
Year	Dive	Trawl	Dive	Trawl	(t)	(t)	(t)	($\$\cdot10^{3}$)	($/t)	Dive	Trawl	Dive	Trawl
1982			1	1	#	#	#	#	#	5	157	54	16
1983	Z 11		4	2	#	8.0	#	#	#	196	N/A	41	
1984	Z 17		5	4	19.9	15.6	4.3	56	2,814	198	115	79	37
1985	Z 22		4	3	21.3	10.8	10.5	139	6,538	43	272	250	39
1986	Z 24		7		35.8	35.7	0.0	212	5,929	542	0	66	
1987	ZI 29		8		69.1	69.0	0.0	244	3,532	1,317	0	52	
1988	ZI 17		9	4	58.0	48.9	9.1	289	4,985	645	318	76	29
1989	ZI 43		7	5	61.5	32.4	29.1	316	5,139	382	917	85	32
1990	ZI 57		9	6	74.2	64.2	10.0	317	4,272	639	356	100	28
1991	ZI 61		7	12	70.7	47.6	23.1	387	5,467	966	550	49	42
1992	ZI 83		6	10	59.5	38.4	21.1	420	7,055	640	625	60	34
1993	ZI 35	ZR 44	8	12	87.1	77.3	9.9	423	4,855	741	453	104	22
1994	ZI 37	ZR 32	15	4	77.6	73.4	4.2	490	6,312	767	109	96	39
1995	ZI 29	ZR 43	14	9	85.9	76.1	9.8	476	5,541	652	843	117	12
1996	ZI 39	ZR 40	14	6	101.9	94.5	7.4	503	4,899	1,073	404	88	18
1997	ZI 41	ZR 38	9	4	77.6	73.6	4.0	376	5,182	1,244	248	59	16
1998	ZI 20	ZR 34	5	5	59.3	54.6	4.7	294	5,389	1,104	266	49	18
1999	ZI 22	ZR 16	8	3	38.9	36.7	2.2	211	5,735	824	181	45	12
2000*	XZI 12	XZR 2	10	-	53.2	53.2	-	319	5,999	1,079	-	49	

* In 2000 both the Dive and Trawl commercial fisheries were discontinued and converted to experimental status.

1999 and 2000 are Preliminary Data

Whole Landed Value is determined using slips and then the Landed value is determined by multiplying this number by the landings from the logs from 1996 onward. recalculation of 96 onwards was done in 2001

# Landings not reported due to confidentiality requirements

Table 2.3.2. Annual landings (tonnes) by management area, 1982 to 200, as reported on harvest logs.

	East Coast Vancouver Island										West Coast Vancouver Island						
Year	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	27	Totals
1982	-	-	-	-	-	-	-	#	-	-	-	-	-	-	-	-	#
1983	-	-	-	-	-	#	6.1	1.7	-	-	#	-	-	-	-	-	#
1984	-	-	-	-	-	-	19.9	-	-	-	-	-	-	-	-	-	19.9
1985	-	-	#	-	-	-	20.8	-	-	-	-	-	-	-	-	-	#
1986	-	-	#	-	-	15.7	12.8	1.3	-	-	-	-	-	-	-	-	#
1987	#	#	#	#	#	23.0	24.4	#	-	15.1	-	-	-	-	-	-	69.0
1988	-	-	-	-	-	9.5	20.1	#	-	#	9.5	-	-	-	-	-	#
1989	-	#	#	-	-	8.5	12.7	-	-	11.0	29.1	-	-	-	-	-	#
1990	-	-	0.3	-	-	29.9	#	-	-	11.5	9.7	-	-	-	-	-	#
1991	-	-	20.4	-	-	15.3	21.1	#	-	11.9	1.9	-	-	-	-	-	#
1992	-	-	20.7	-	-	20.7	#	-	-	18.1	-	-	-	-	-	-	#
1993	-	1.7	6.9	-	-	17.0	18.5	-	-	41.1	1.8	-	-	-	#	-	#
1994	#	#	#	-	#	18.8	10.4	3.4	-	40.5	-	-	-	-	-	-	77.6
1995	-	3.9	5.1	-	#	10.9	9.9	#	-	52.9	#	-	-	-	-	-	85.9
1996	-	#	5.2	#	#	27.1	40.5	#	-	24.5	-	-	-	-	-	-	101.9
1997	-	#	5.8	#	#	#	28.8	#	-	31.7	-	-	-	-	-	-	77.6
1998	-	#	6.4	#	-	#	39.1	-	-	#	#	-	-	-	-	-	59.3
1999	-	#	13.1	-	-	1.1	21.0	-	-	#	#	-	-	-	-	-	38.9
2000	-	#	30.7	#	-	13.1	8.7	-	-	#	-	-	-	-	-	-	53.2
Totals	#	14.9	125.9	2.3	4.2	228.9	337.7	12.3	0.0	281.0	53.5	0.0	0.0	0.0	#	0.0	1,062.5
%	#	1%	9%	0%	0%	21%	32%	1%	0%	28%	5%	0%	0%	0%	#	0%	

# Landings not reported due to confidentiality requirements

Table 2.3.3. Summary of scallop landings (tonnes) in 2000, by all gear, as reported on harvest logs.

	SOUTH COAST MANAGEMENT AREAS																		
	East Coast V.I.										West Coast V.I.							Monthly
Month	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**28**	**29**	**20**	**21**	**23**	**24**	**25**	**26**	**27**	**Totals**
Jan				#			#	#			#								4.0
Feb				#			#	#											4.9
Mar				1.53			#	1.60											5.5
Apr				2.59			#	#											3.7
May				#			2.20	#											4.7
June			#	#			#	#											5.8
July				4.32			2.59	#											7.4
Aug				3.83			#												4.1
Sept				3.53			#	#											4.0
Oct				2.97			#	#											3.6
Nov				2.82			#	#											3.6
Dec				1.75	#		#												1.9
Area Totals			#	30.66	#		13.11	8.68			#								53.2

# Landings not reported due to confidentiality requirements

2.4. Intertidal Clams – R. Webb

2.4.1. Introduction

This fishery update provides overview of the intertidal clam fishery in terms of commercial and domestic harvesting on the coast of British Columbia.

2.4.2. Biological Synopsis

Over 400 species of clams are found along the coast of British Columbia, but only a few are commercially or recreationally harvested. The information in this document relate primarily to the four commercially harvested species which include Manila clam, (*Venerupis philipinarum*) Littleneck clam, (*Protothaca staminea*) Butter clam (*Saxidomus giganteus*) and Razor clam (*Siliqua patula*). The most widely harvested species is the Manila clam that was accidentally introduced in the 1930's with oyster seed from Japan. Manila clams as with all the intertidal clams are broadcast spawners. They are sexually mature in approximately 2 years at 20-25 mm shell width and reach the minimum legal harvesting size of 38 mm between 3 and 4 years.

2.4.3. Overview of the Fishery

Four species of intertidal clams; butter, littleneck, manila, and razor clams comprise the major portion of landings in commercial and recreational fisheries. Intertidal clams are harvested by hand digging only during low tide cycles. Although the commercial clam fishery began just before the turn of the century, landings were not reliably recorded until 1951. Since 1971, strong markets and higher prices for Littleneck and Manila clams have focused the intertidal fishery on these two species. The landings of butter clams, has been low in recent years because of the high cost of processing and a shift in demand toward fresh steamer clams. There is increased interest in the past two years to reactivate the butter clam fishery. The razor clam fishery is active only near Masset on the Queen Charlotte Islands.

The manila clam is the species most widely sought after. This clam is predominately found in south coast British Columbia although there are isolated stocks in the central coast areas. Due to the geographic location of manila clams, the commercial fishery is focused mainly in the south coast at this time. Water quality issues have precluded expansion of most intertidal clam fisheries in the central and north coast areas although the Heltsiuk First Nation in the Central Coast does have access to a communal fishery.

The intertidal clam fishery went through a consultative and rationalisation process called “Clam Reform” from 1992 to 1998. The fishery was over subscribed since the mid 1980's and changes were needed to make it more manageable and economically viable. Area management was introduced in 1989, which divided the coast into 7 areas. Through the consultation process, license limitation was implemented in 1998 and local area management boards were introduced in two of the areas. These initiatives have made the fishery more manageable and have increased individual economic benefits to the eligible harvesters.

The intertidal clam fishery is small in relation to many other British Columbia fisheries, however it is important to coastal communities and provides needed employment to many people. Furthermore, intertidal clams are a traditional food source for First Nations and are widely used in the recreational fishery. There are significant public health and safety issues in this fishery due to the potential for naturally occurring marine biotoxins and to fecal contamination.

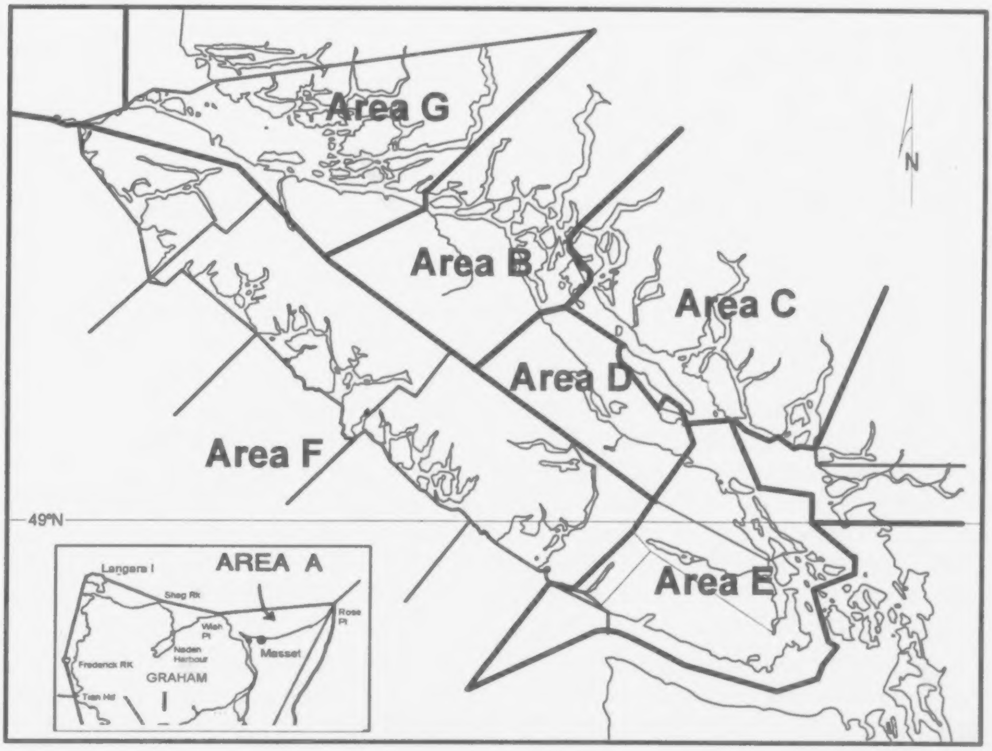
2.4.3.1. Participants

The commercial fishery was historically an open fishery with no limit on the number of licences. The fishery was extremely over subscribed and fishing opportunities were very limited. A policy of "Clam Reform" was introduced to make the fishery more manageable. One of the components of "Clam Reform" was to limit entry. In 1998 the clam fishery became a limited fishery based on eligibility criteria. These criteria reduced the number of harvesters from approximately 2000 harvesters/year to a fixed number of 1144. In keeping with the clam reform policy, approximately 50% of these license holders are First Nations participants.

In the South Coast there are no limits on the number of recreational harvesters and access to the resource for food, social and ceremonial purposes by First Nations is virtually unlimited.

2.4.3.2. Location of the Fishery

The commercial fishery incorporates area licensing. There are a total of 7 license areas on the coast (Figure 2.4.1). Area "A" is the Queen Charlotte Islands razor Clam fishery. The Heiltsuk First Nation in Bella Bella has a communal commercial fishery in Area 7 however all other north and central coast areas are closed due to lack of funding for both water quality surveys and biotoxin monitoring. The remainder of the clam harvesting areas are located in the south coast.



A: North Coast
B: Johnstone Strait
C: Sunshine Coast
D: Upper Strait of Georgia
E: Lower Strait of Georgia
F: West Coast of Vancouver Island
G: Queen Charlotte Sound

Figure 2.4.1. Commercial clam license areas.

2.4.3.3. Time Frame of Fishery

The fishery is designed to allow openings throughout the year. Each of the 6 south coast areas fishes during a specific portion of the year. The openings in each area may vary from one to five days duration with a week or two closed between openings. This staggered fishing plan allows for product to be supplied to the processors on a regular basis and stabilises their markets. Individual area openings are occasionally modified in order to deal with market demand.

2.4.3.4. Landings /Values / Markets

In past years, the information for this report was generated from the DFO sales slip database. It is the observation of the author that this information is often incorrectly reported, some information is missing entirely and in some cases is incorrectly recorded. In the South Coast the intertidal clam fishery is actively managed and landings are hailed to the manager after each fishery. In keeping with the department's policy of using the best estimate of catch, this update will be based on the in-season catch numbers and not the sales slip data. In the North coast the razor clam fishery landings are from reports from the Haida Nation and the Central Coast manila clam fishery in Bella Bella is from reports from the Heiltsuk Fisheries. At the time of writing this report, all 2000 catch landings were considered to be preliminary. Rationalisation of the sales slip database will continue and this data may be used in the future.

The majority of intertidal clam landings and fishing activity is from the South coast. Table 2.4.1 compares the landings from south coast clam fishing areas since 1990. These landings include any aboriginal pilot fisheries that occurred. Tables 2.4.2 and 2.4.3 are a comparison of fishing days per license area and commercial licenses issued. Of interest is the increase in fishing days associated with the implementation of limited entry into the fishery in 1998. The depuration fishery is currently managed separately from the regular commercial fishery. The landings from the depuration fishery are reported in Table 2.4.4.

In 2000 the combined landings of clams (manila, littleneck butter and razor) was 1546 metric tonnes (preliminary) compared to 1638 tonnes in 1999. The estimated landed value for the entire intertidal clam fishery is $4.7 million compared to $5.3 million in 1999 (Table 2.4.5). The average price per pound for wild manila clams in 2000 was $1.73, down slightly from $1.76 in 1999. Littleneck prices were approximately $1.00 lb. and butter clam prices were as high as $.45 lb. The fishery in the south coast was open 183 days in 2000 compared to 193 days in 1999. This decrease in fishing time and landings from 1999 is mainly attributable to a reduction in fishing time in Area "F" on the WCVI due to conservation concerns expressed by the Area F Clam Management Board. PSP closures in several areas and cold weather conditions in December also precluded fishing opportunities.

The commercial butter clam landing of 98 metric tonnes in 2000 is down from 140 tonnes in 1999. This decrease is directly related to a reduction in activity in Area G (Statistical Area 12). The Area D catch of butter clams is from Seal Island (Area 14). This area had a quota of 40,000 lbs however market demand was the primary reason for a lower catch (Table 2.4.1).

The 2000 South Coast landings of 1.8 million lbs of wild manila/littleneck clams and 756,000 lbs of depurated wild clams is slightly less than the 1999 catch. In the "wild" fishery, this reduction is mainly attributed to in-season management actions on the WCVI (Area F) by the Area F Clam Management Board. The board recommended a reduction in the fishery in order to respond to suspected conservation concerns in parts of the WCVI. In the depuration fishery, the landings are slightly lower due to inability to achieve quota in several areas due to lengthy PSP closures and in some cases a reduction in quota based on annual biomass surveys.

The license limitation initiative introduced in 1998 in the South Coast reduced the number of harvesters by almost 50% and as a result there is generally more opportunity for the remaining license holders. (Table 2.4.2). This generally equated to a higher average income per license although in the case of Area F due to the restricted fishery this year, average income is down considerably. The income per active digger is likely higher yet since not all the licenses purchased were actually fished (Table 2.4.6).

The majority of the manila and littleneck clams are exported to the United States for the "steamer" clam market. This steamer clam market has seen some recent changes, and the manila clam market has been reduced as a result of increased availability of cultured product in Canada, the United States and Mexico. In 2000 on average the price per pound of manila clams sold to the United States was $2.25 US ($3.41 Canadian, total value approx $8.9 million). There is a small market for processed butter clams for chowder and a growing market for commercial crab bait. Razor clams are harvested primarily for bait in the halibut fishery although markets are developing for razor clams as a food product.

The recreational fishery is not monitored at this time nor has it been in the past. There are no landing records however the recreational harvest is considered to be minimal compared to the commercial harvest and presents no conservation concerns at this time. The main issue in the recreational fishery will be access to stocks and development of "recreational" only areas. Currently, this is not a major issue but as more tenures are granted, access in some areas may be a problem and steps will have to be considered to deal with the issue.

2.4.3.5. Consultative Process

Under the Clam Reform strategy, the Department is attempting to incorporate community input into the management of the fishery. There are two "Clam Management Boards" that were formalized in 1998. The Area "F" Board is on the West Coast of Vancouver Island and the Area "C" Board is in the Powell River area. These boards provide advice and input into the management of the commercial clam fishery in their area and are structured to have broad stakeholder support. In addition to these Boards, there is an ad hoc regional advisory committee called the Pacific Region Clam Management Committee. The purpose of this committee is to provide the Department with advice on regional issues in the fishery. Attempts to encourage broad stakeholder involvement continue in this committee, and at present, the commercial processing industry, various First Nation groups, clam management boards, the B.C. Shellfish Growers Association and the Province are represented. This regional committee is continuing to be restructured. In keeping with the community management board concept, local advisory meetings have been initiated in two other areas of the south coast in an attempt to improve consultation with stakeholders.

2.4.3.6. Management Style

The primary management tool in the commercial fishery is a minimum size limit. The size limit is set to ensure that recruiting stock can spawn at least once before being harvested in the fishery. Active in season management is undertaken by time and area closures. Managers are aware of historical annual catch levels in each of the fishing areas and these catch levels are used as a rough catch ceiling. Once these catch ceilings are reached in any given fishing area, the fishery may be closed. These precautionary catch levels are incorporated due to a lack of specific stock assessment information available to the fishery. The implementation of management boards in two of the areas has resulted in more flexibility in managing area openings due to improved local knowledge and first hand information on stock strength. In terms of the depuration fishery, surveys are conducted on available beaches and quotas are assigned. The quotas range from 10 to 40% of legal sized biomass. As a result of a PSARC recommendation, quotas are assigned based on clam density rather than just biomass. Annual surveys are required on many beaches.

2.4.4. Stock Status

2.4.4.1. Biology, Environment, Habitat

The three species (manila, littleneck and butter clams) have similar life cycles. The sexes are separate, and spawning involves release of gametes into the water column, where fertilization occurs. After a planktonic period of 3-4 weeks, depending on species, temperature and available food, the larvae settle and take up an infaunal existence. Exchange of adults among beaches does not occur, i.e., adult populations are considered closed. There may be mixing of clams within suitable habitat, but no exchange of adults between isolated patches of habitat (i.e., between beaches) occurs. Recruitment, or animals coming into a population, is variable. In some cases, a number of years can pass without significant influx of new animals to a harvestable population (Quayle and Bourne 1972). This may be due to poor settlement of larvae at a beach or due to a high rate of juvenile mortality that reduces the number of clams growing large enough to enter the fishery.

2.4.4.2. Assessment

In 2000, Stock Assessment activities relating to the commercial fishery for intertidal clams included: (1) development of stock estimates and monitoring of biological characteristics of clam stocks at Parksville Bay; (2) collaborative survey design, sample processing and analyses for the depuration fishery; and (3) collaborative survey design, sample processing and analyses for the Aboriginal communal commercial and depuration fisheries.

Activities relating to the depuration fishery in the South Coast included: (1) consultation with depuration processors regarding assessment survey design and protocols, and biological sampling requirements; (2) evaluating stock estimates from sites surveyed by depuration processors in 2000; (3) development of stock size estimates and summaries of biological characteristics of exploited stocks; and (4) development of an overall stock assessment plan for policy discussions with the depuration industry.

Activities in support of AFS communal commercial fishery pilots in the South Coast included: (1) consultation with First Nations groups regarding assessment survey design and protocols and biological sampling requirements; and (2) development of stock size estimates and summaries of biological characteristics of exploited stocks.

2.4.4.3. Research

A preliminary review of experimental harvest rates used in the depuration fishery was produced and reviewed by PSARC (Gillespie 2000). The paper recommended reductions in the harvest rates used in this fishery, that managers consider alternatives to constant harvest rate approaches, and that new procedures be developed to improve landing statistics. The paper further suggested a system of harvest rates linked to reference points linked to legal densities from survey information.

Collaborative work with Community Futures Powell River and the Province of British Columbia was undertaken to develop biological information and assess fisheries potential of the exotic varnish clam, *Nuttallia obscurata*.

2.4.5. Current Management Issues

2.4.5.1. Clam Reform

The main issue remaining to be resolved under clam reform is the issue of transferability of licenses and how it should be permitted. This issue is to be resolved in 2001.

2.4.5.2. Lost Clam Beds

Pollution from municipal sewage and storm water outfalls, faulty septic fields, agricultural run-off or discharge from vessels resulted in closures of 102,000 hectares including shellfish habitat in 1998. This is an increase of approximately 30% since 1993. Additional foreshore is being closed each year and the incidence of contaminated bivalves is becoming a serious problem in the Strait of Georgia. This issue is significant to the commercial fishery because new closures mean a loss of available beach to fish on openings. In the Baynes Sound area, which is heavily tenured, the aquaculture industry and BC Ministry of Fish have worked with DFO, CFIA and DOE to develop a management plan to do extra monitoring of water and shellstock quality in order to meet CSSP requirements. This initiative is called the Baynes Sound Management Plan. The Baynes Sound Management Plan allows for the area to be open at times when rainfall levels are low. The industry must do regular sampling of water quality and have a plan in place to contact shellfish growers when the rainfall exceeds acceptable levels and the area closes. This initiative is a special management plan to allow harvesting in an area with identified fecal contamination under certain circumstances i.e. heavy rainfall events. Similar initiatives may be developed on parts of the WCVI with identified fecal contamination problems.

2.4.5.3. Market Considerations

Competition for markets seems to be increasing. There is increased production from clam farms, increased production from the depuration fishery, and there is production from Washington State beaches flooding the same markets with Puget Sound product in the spring. In addition, markets are being impacted by the production of "Venus" clams in Mexico and New Zealand cockles, which are imported to the U.S. at a lower price than Canadian manila clams. With so many possible sources of product, the value of the commercial fishery may in fact be reduced in the future. Whenever possible, clam openings each year are designed to fit the market demand and avoid this competition issue. In 2000 the Canadian manila clam maintained good export markets throughout most of the year.

2.4.5.4. Uncertain Stock Levels

There is currently no assessment program that measures stock strength on all the individual beaches that are harvested in the fishery. The stock assessment program identifies biomass on specific beaches in the depuration fishery and Aboriginal pilot fisheries with a goal of determining maximum sustainable harvest rates. Only one commercial beach has been assessed on a regular basis, i.e. Savary Island with a goal of determining stock dynamics and population characteristics. In the fishery the stocks are managed based on comparison of annual catches in each area and by catch per unit effort. There is some concern that intensive commercial harvesting and repeated digging may negatively impact clam survival and growth rates. There is also concern that even with existing minimum legal size limits, which are set above the size of reproductive maturity, heavy exploitation of the entire legal sized clam resource may negatively affect recruitment rates. The impact of winterkill is an unknown until harvesting occurs each year and CPUE is impacted.

Harvestable wild clam stocks are dependent on annual recruitment, which can vary widely from year to year. Manila clams are highly susceptible to winter kills which can result from freezing; these mortalities can dramatically affect stock sizes and consequently annual landings in any area.

2.4.5.5. Under-funded programs

Little is known about stock composition of clams on the north coast. Manila clam stocks have been identified as far north as Aristazabel Island (520 30' N) (G. Gillespie - personal communication). Littlenecks and butters are common but poor markets limit fishery growth. There is pressure from First Nation groups in particular to have the north coast opened to bivalve harvesting. In order to open the entire North Coast to bivalve harvesting by all user groups, additional funding is required for management and enforcement costs.

The most significant issue in the North Coast is the ability to monitor biotoxins and conduct water quality surveys. Currently, much of the B.C. coast is closed to clam harvesting due to lack of funding for these programs. Industry has indicated a willingness to participate in funding new programs needed to develop new fisheries. For example, commercial geoduck harvesters contribute to the monitoring expenses incurred in shellfish harvesting in the Central Coast. The Aboriginal Fishery Strategy has funded some programs in the Central Coast to allow for PSP monitoring which has permitted the development of a limited commercial fishery by the Heiltsuk First Nation in Bella Bella. Industry has assisted with funding for water quality surveys in several growing water areas since 1996, however government funding to Environment Canada water quality surveys continues to be cut. There is increasing pressure for resource users to fund this program with no clear means to accomplish this task.

2.4.5.6. New Species

Scientific licenses were issued in 2000 to obtain the necessary information to allow proper management of *Nuttalia obscurata* or varnish clams. For more information on varnish clams please see Gillespie et al. (1999).

2.4.6. Long Term Objectives for the Fishery

In the conventional commercial fishery the long term objectives, as detailed in section 1.0 are addressed by a minimum size limit, which allows clams to spawn at least once before reaching harvestable size, and time and area closures. For depuration and First Nation pilot fisheries, which are managed in a more conservative manner than the conventional fishery, total allowable catch (TAC's) (expressed as a proportion of the available legal-size stock based on stock density are developed).

2.4.7. Specific Management Objectives

2.4.7.1. Conservation / Sustainability

- To ensure conservation and protection of intertidal clam stocks by enforcement of the minimum size limit and protection of juvenile stocks.
- To ensure the optimal use of clam stocks to meet the social and economic objectives of the people of Canada recognising the priority given to First Nations for food, social and ceremonial purposes.
- To develop fishing plans consistent with principles of conservation through a consultative process with users of the resource and development of community management boards where feasible.
- To supply product to the market year round.
- To optimize the quality of clams harvested.

2.4.7.2. Domestic Considerations

Aboriginal Fishery:

Food, Social and Ceremonial Fishing

First Nations residents of B.C. have the right to harvest clams to meet their food, social and ceremonial needs. The Government of Canada is obligated to respect these requirements while maintaining conservation of the clam resource. Generally, all non-contaminated beaches are available for food, social and ceremonial harvest all year subject to communal license conditions. In some areas, upon request from First Nation organizations, some beaches have been closed to commercial fishing in order to ensure native food fishing access year round. A major concern is that pollution has forced the closure of shellfish beaches near native villages, and some native harvesters have to travel greater distances to find clams for food fish.

Commercial Fishing

The Government of Canada also recognizes the needs of First Nations for commercial clam fishing opportunities. DFO is committed to:

- Negotiating First Nation fisheries agreements. These agreements may provide a specific quantity of fish for food purposes and may also allot a proportion of the catch to be used for economic development opportunities.
- Protecting existing First Nations participation in commercial fisheries and encouraging new native entrants.
- Establishing areas reserved for First Nation subsistence (food) fisheries.

In 1998 with clam reform and the implementation of license limitation, many First Nations people were excluded from the commercial fishery. In recognition of historical participation by First Nations in the clam fishery, the Department negotiated a number of Aboriginal Commercial Licenses with interested Bands. These licenses allowed participation in the commercial fishery at the discretion of the Chief and Council. The licenses are identical to any other commercial clam license except the chief and council can designate the member annually.

Present management of the commercial clam fishery conflicts with both traditional and new development opportunities for B.C.'s First Nations. Short fishing seasons displace commercial First Nation diggers who have traditionally harvested part time throughout the year. As part of the clam reform process, opportunity to harvest commercially and co-manage beaches was initiated in the form of "pilot projects" on open beaches and "joint ventures" for depuration on contaminated beaches that are fronting or immediately adjacent to existing I.R.'s.

First Nation Co-Management

Pilot projects using co-management arrangements are providing commercial opportunities for First Nations on the coast. For example, the continuation of a 1992 pilot project in the Central Coast supplies additional clams to the market and provides much needed employment in the Bella Bella area. In the South Coast a pilot project continues Squirrel Cove on Cortes Island with the Klahoose First Nation.

First Nations are becoming involved in monitoring the clam resource in cooperation with the DFO. The Heltsiuk Band Council has been given exclusive harvesting privileges in the Bella Bella area from 1992 through to present. The licence authorized 50 Heiltsuk individuals to harvest 250,000 pounds (113.4 t) each of Manila, littleneck and butter clams. As a result of concerns that this level of harvest was not sustainable and due to the fact that littlenecks and butter clams were not being harvested at all, the quota for this fishery was reduced to 150,000 lbs. and only for manila clams. In 2000 the harvest was 182,437 lbs. of manila clams. This fishery is conducted on a seasonal basis where the quota is assigned for the period of November to April and therefore reporting annual catch by calendar year is confusing.

The Haida Nations in the Queen Charlottes have worked with DFO and established a co-management program for razor clam fisheries in the Queen Charlottes (Subarea 1-5). Razor clams are delivered to a plant in Masset. The clams are primarily sold as bait to be used in the crab fisheries in Washington and Oregon, however a food market is being developed. In 2000 landings were 521,472 lbs. valued at $469,000 as reported by the Haida Fisheries Program. This is more than double the average catch and the fishery was closed in August as there was concern the catch exceeded the maximum sustained yield. Conservation is effected through a minimum size limit of 90 mm. and a sport bag limit for recreational fishers. Most of the participants in the fishery are Haida natives and there is limited licensing of non-native harvesters. A cooperative program of fishery monitoring and stock assessment is in place.

Following stock assessments by the Klahoose band, a conservative harvest of 11,636 lb. (5.2 t) was set for 99/2000 which is approximately 20% of the estimated legal Manila clams. The catch was restricted by the Klahoose Band at 3,888 lbs in 2000 due to conservation concerns. The Klahoose First Nation has dealt with this situation in season and has reduced fishing effort accordingly. This pilot project is still a valuable opportunity for this group and they have over the years shown a responsible approach to the project. The First Nation has decided to forgo any further fishing until a new stock assessment can be done in summer of 2001.

Biomass surveys at both Kuper Island and Kulleet Bay have been undertaken in the past but must be updated with current information prior to any further harvesting.

First Nations in the Alert Bay to Sunshine Coast areas and the west coast of Vancouver Island are becoming more active in participating in the management of the local clam fisheries and are indicating a desire to be considered for pilot projects.

Commercial Fishery:

Open Fishery

In 1998, the process of Clam Reform was implemented. This fishery is now a limited fishery with significant reductions in effort. Furthermore, the Department has undertaken to develop Community Management Boards for the clam fishery in Area "F" (WCVI and Area "C", Sunshine Coast). Attempts at structuring similar boards in Area "G" and "E" were met with some resistance and are presently on hold. Significant gains have been made in the fishery as a result of this clam reform initiative, the most obvious is a reduction in the amount of diggers (approximately 50% of recent years effort). This means that there are fewer harvesters in each area and therefore more fishing days available. Accordingly, the harvesters see a greater economic benefit individually and consider themselves as stakeholders in the clam resource which will lead to improved management and improved enforcement. The community management boards will, over time, have some opportunity for increased responsibilities and input. First Nations play a significant role in the commercial fishery both in terms of commercial licenses and in pilot projects. Under this Clam Reform initiative there are opportunities for First Nations to participate in the commercial fishery as well as co-manage beaches fronting or immediately adjacent to reserves.

There is some concern for loss of additional beaches through Park initiatives, contaminated closures and additional tenures issued by Provincial authority which will alienate vacant crown foreshore from the fishery.

Depuration Fishery

Licensed and approved processing plants are permitted to harvest and depurate clams from marginally contaminated areas in the South Coast inside waters. Depuration licences assign the processor control and responsibility for harvest on designated beaches. The plants operate year round and provide a consistent supply to the market. A total of five plants have become licensed to operate with a total harvest from vacant crown foreshore in 2000 of 343 t. (755,654 lbs; Table 2.4.4.).

As more shellfish beach is considered to be contaminated each year, it is obvious that the industry will look to depuration as a way of maintaining production. A policy for dealing with depuration requests has been developed and must be applied consistently as the demand for depuration licences increases.

A draft policy was developed in 1996 in consultation with the depuration industry, which details the strategy for conservative management of the depuration clam fishery. Stock assessment requirements, harvest rates, harvest notification and catch reporting procedures are detailed the policy, "The Harvest of Clams from Contaminated Areas - A Three Year Plan". This policy was extended until October 2000 has undergone slight revisions and is currently being reviewed for implementation.

While there are benefits to expanding depuration activity in the province from an economic point of view, there are difficulties as well. Clams in contaminated areas may be a brood stock reserve providing seed for adjacent wild beaches and their harvest may negatively impact the overall clam population. As a consequence, conservative development of the depuration fishery was adopted in the 1996 Policy and the fishery is actively managed.

With the implementation of Clam Reform, First Nations with contaminated beaches fronting Reserves have been given the opportunity to harvest for depuration. In order to do so they must reach an agreement (Joint Venture) with a registered depuration facility. First Nations diggers are then authorized to harvest under the control and supervision of the depuration plant subject to the conditions identified in the Contaminated Shellfish Harvest License. Biomass surveys must be undertaken and a TAC based on density is authorized. This "Joint Venture" opportunity has resulted in significant economic gains to several First Nations and allows for controlled harvesting of the product.

The majority of contaminated areas suitable for depuration operations are located within populated areas. Depuration harvest has caused controversy as local residents object to increased harvesting fronting residential neighbourhoods. The 1996 Policy recommends that licensed processors undertake public relations activities in their areas of harvest to inform local residents of their activities.

In order for the Department to administer and properly manage the depuration fishery and related issues, additional resources were required. The depuration industry formed an Association and contributes financially through a collaborative agreement with the department for the management of this fishery.

Clam Culture

Clam aquaculture is managed and licensed by the provincial Fisheries Ministry (BC Fish) and B.C. Assets and Land Corp (BCALC). In order to maintain a tenure, the Ministry requires diligent use of the site. The Province of B.C. has recently embarked on an expansion to shellfish aquaculture. This program is called the Shellfish Aquaculture Development Initiative and the goal is to double the amount of ground under tenure within 10 years. This active move to tenure more ground has ramifications to existing users and discussions between provincial and federal agencies is underway to resolve conflicts.

Clam farm production for 1999 was 900 t with a farm gate value of $3.8 million dollars. In 2000, the landing and value is preliminary at 677 tonnes valued at $4.0 million. Of this production, a significant amount is sub-legal clams. Amendments to the Pacific Fishery Regulations in 1997 exclude the requirement for maintaining a size limit on farmed clams from an aquaculture operation licensed by the province. There is no available data on the total landings of sub-legal manila clams. As new farmers get into operation, there is potential to substantially increase clam production in B.C. In 2000 at total of 219 Clam Culture Farms have been licensed by the Province, a 20% increase from 1999. The landings of farm product also include clams from contaminated clam leases harvested for depuration.

Recreational fishery:

Recreational clam digging is enjoyed by local residents and visitors to B.C. The value of this fishery is closely tied to enjoyment of the marine environment and year round opportunities for beach combing. Recreational reserves have been created to preserve recreational opportunities in areas of high demand. Some coastal residents have expressed frustration with the intensity of the commercial clam fisheries and the perceived disturbance created on their local beaches. Commercial fishery closures have been implemented in many provincial and municipal parks where recreational or aboriginal harvest for food social or ceremonial purposes is still permitted. Additional reserves may have to be created in light of Provincial tenure expansion reducing vacant crown foreshore access to shellfish by the public. Recreational fishing pressure is controlled with a daily bag limit of 75 clams. DFO is receiving requests for additional reserves near coastal communities.

In Canada's Policy for Recreational Fisheries, DFO and the Provinces of Canada announced a commitment to "maintain a high quality and diversity of recreational fishing opportunities". Additional efforts will need to be made to maintain quality recreational clam fishing in British Columbia.

In 1995, the recreational tidal waters licence was amended and it is a requirement for all sport fisheries including those who harvest shellfish to be in possession of a licence. There are presently no estimates of effort levels or catch from recreational clam harvesting.

2.4.8. Management Measures

2.4.8.1. Fishing Seasons

Timing of openings is developed in such a manner as to provide for some harvesting activity throughout the year. This requirement is necessary in order for the processing industry to maintain their markets year round. Accordingly, the general fishing periods are flexible to allow for market fluctuations. The time frame of the fishery in each of the areas is described in general terms in the following table.

Table 2.4.1. Summary of Area Openings

AREA	DESCRIPTION	SUMMARY OF OPENINGS
A	Queen Charlotte Islands	Fishery open from January to August depending on PSP/ASP monitoring. (closed in August due to high catch rate and need for reassessment)
B	Johnstone Strait	Fishery April through June and August through December. Specific openings subject to consultation and fishing effort.
C	Sunshine Coast	Openings developed with local management board. Opening dates will occur during spring and fall.
D	Upper Strait of Georgia	Fishery developed for June through August. Specific openings subject to consultation and fishing effort.
E	Lower Strait of Georgia	Fishery proposed for January through April. Specific openings subject to consultation with industry. (Possible Dec. openings).
F	West Coast Vancouver Island	3 consecutive days commencing in January and again in February on fishable tide cycles. Specific openings subject to consultation with management boards. Conservation concerns and PSP closures restricted openings.
G	Queen Charlotte Sound (Area 12)	Fishery open on tide cycles in January to March and October to December. Subject to consultation and fishing effort.

Due to the nature of the bivalve fishery, openings may be suspended or delayed in-season due to the presence of PSP or ASP.

2.4.8.2. Control and Monitoring of Fishing Activities

Open fishery:

The main conservation tool utilised in this fishery is a minimum size limit and time and area closures. The minimum size limit for the species harvested is as follows: 63 mm shell length for butter clams and 38 mm for littleneck and Manila clams. The razor clam minimum size is 90 mm. Currently, in the recreational fishery there is no size limit but rather a daily quota and the fishery is open year round except for PSP or contamination closures. Application of a minimum size limit ensures that clams become sexually mature and can spawn at least once before they can be legally harvested. The time and area closures are fine tuned in-season to adjust for annual stock recruitment in specific areas and to deal with market fluctuations.

Commencing in 1998 the fishery became a limited fishery. There are currently 1144 participants eligible although in 2000 only 970 licenses (preliminary) were issued (Table 2.4.3). As a result of license limitation there is better communication with the harvesters and an opportunity to be more flexible in the openings. As a rule of thumb, catch per unit effort is still used to manage the fishery. When catch per digger per tide begins to fall dramatically, and reduced numbers of legal sized clams become available, beaches are closed to commercial harvest. During the fishing season meetings or telephone consultations are held with industry representatives in each area to determine the strategic sequence of fishery openings and closures. In the two areas with community management boards in place, there is considerable discussion about stock status, conservation concerns and potential for openings.

In terms of monitoring, the Fishery Officers are crucial to informing the manager of problems or issues they have observed while patrolling the fishery. The increased stakeholder mentality with the eligible harvesters has improved communication in terms of management issues and has allowed for better use of enforcement resources in general.

Depuration Fishery:

This fishery is regulated under the Management of Contaminated Fishing Regulations. A special "Contaminated Shellfish Harvest Licence" is required to harvest in any closed area. Licence requirements include industry funded stock assessment surveys at each beach. TAC's are set based on the estimated standing stock present on each beach, in combination with the harvest history to date. In 2000, harvest rates have changed as a result of PSARC recommendations and vary from 10 to 40% of legal biomass depending on the density of the clams in the harvest area. Stock surveys as part of the management strategy are providing valuable information on the sustainability of different harvest levels

2.4.8.3. Other Relevant Elements

Licensing

Area licensing in the commercial fishery has been in place since 1989. In January 1998 license limitation was initiated in the fishery. At the present time the licenses are owner operator and are not transferable. A harvester is only permitted one license for one area. A policy regarding the transferability of licenses is to be developed by January 1, 2002.

2.4.9. Enforcement Issues and Strategies

There is an increasing problem with monitoring and enforcing illegal clam harvesting on beaches closed for conservation reasons or beaches closed due to faecal contamination. Poaching of contaminated clams poses a serious health risk and could cause serious marketing problems for the B.C. shellfish industry. The ability of the Department to control contaminated and closed area fishing is questionable with present resource cutbacks and reorganization.

Curtailing the illegal fishery is simply impossible to achieve with the present enforcement resources and priorities. The tide goes out twice a day every day and for six months of the year low water occurs in the dark. Many beaches on the West Coast of Vancouver Island are in remote areas with little or no enforcement coverage.

The de-regulation of the size limit on clams from aquaculture leases is a major concern as it opens the door to illegal harvesting and laundering of sub-legal clams through leases.

The issue of incorrect or non-existent fish slips continues to hamper reporting on this fishery. As previously mentioned, this update is based on in-season hails obtained by the Fishery Manager rather than the information on fish slips. Accurate catch reporting is a management issue and as such is also an enforcement issue. The department must consider ways of dealing with this situation.

2.4.10. Financial Responsibilities

The Department has a collaborative agreement in place with the Depuration Industry to co-manage depuration activities. This arrangement allowed for a specific manager to oversee the depuration fishery, track allocations, issue licenses and consult with specific user groups including First Nations.

2.4.11. Performance Review

License limitation in the fishery has resulted in increased manageability, increased communication with stakeholders, increased fishing opportunity and increased income to individual harvesters. Management Boards that were set up in Area “F” and Area “C” have contributed to the overall management of the fishery in their respective areas. The fishery continues to be sustainable at the current level of harvest but is subject to annual recruitment cycles.

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Table 2.4.2. South Coast hailed landings (lbs) 1990 to 2000: Manila, Littleneck and Mixed clams combined and Butter Clams

LANDINGS IN POUNDS MANILA, LITTLENECK AND MIXED

AREA	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average
B	-	381,000	323,000	287,000	403,335	350,272	312,348	234,099	199,510	243,556	396,374	313,049
C	-	200,000	200,775	247,000	432,026	498,579	549,832	707,334	740,733	693,988	636,173	490,644
D	1,000,000	781,095	694,237	500,000	598,668	351,447	356,937	155,980	380,457	323,094	244,062	489,634
E	-	-	-	375,000	597,918	334,321	350,056	244,389	346,374	406,908	298,073	369,130
F	-	-	-	476,218	495,792	753,998	637,248	682,623	662,326	341,819	162,427	526,556
G	-	-	-	-	110,532	92,314	106,116	132,555	68,853	122,091	107,416	105,697
TOTAL	1,000,000	1,362,095	1,218,012	1,885,218	2,638,271	2,380,931	2,312,537	2,156,980	2,398,253	2,131,456	1,844,525	2,294,711

LANDINGS IN POUNDS - BUTTER CLAMS

D	-	-	-	-	-	-	-	40,818	40,580	30,303	30,818	35,630
G	-	-	-	-	106,611	106,646	90,410	197,066	71,007	278,417	185,981	148,020
TOTAL	-	-	-	-	106,611	106,646	90,410	237,884	111,587	308,720	216,799	183,640

Table 2.4.3. South Coast hailed landings (tonnes) 1990 to 2000: Manila, Littleneck and Mixed clams combined and Butter Clams

LANDINGS IN TONNES MANILA, LITTLENECK AND MIXED

AREA	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average
B	-	173	147	130	183	159	142	106	90	110	180	142
C	-	91	91	112	196	226	249	321	336	315	289	223
D	454	354	315	227	272	159	162	71	173	147	111	222
E	-	-	-	170	271	152	159	111	157	185	135	167
F	-	-	-	216	225	342	289	310	300	155	74	239
G	-	-	-	-	50	42	48	60	31	55	49	48
TOTAL	454	618	552	855	1,197	1,080	1,049	978	1,088	957	837	1,041

LANDINGS IN TONNES BUTTER CLAMS

D								19	18	14	14	16
G					48	48	41	89	32	126	84	67
TOTAL					48	48	41	108	51	140	98	83

Note: Area B landings include Aboriginal Pilot Sales for 1997 - 1999

Note: 2000 values are preliminary

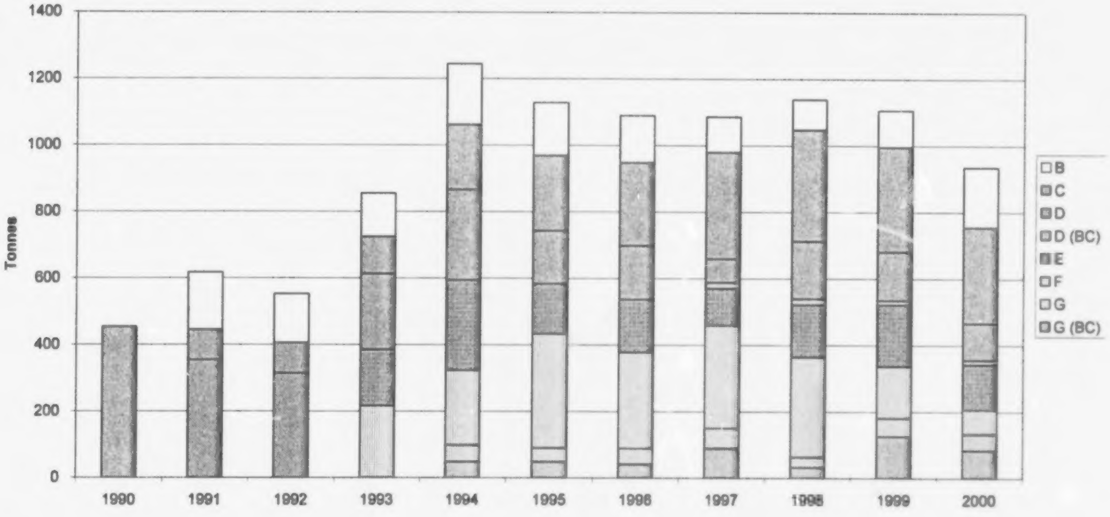

Figure 2.4.2. South Coast hailed landings (tonnes) of Manila, Littleneck and Mixed clams combined and Butter Clams (BC), 1990 to 2000 by Clam Management Area.

Table 2.4.4. South Coast commercial fishing days, 1990 to 2000.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Average
Area B	-	16	18	8	8	6	4	6	15	18	30	13
Area C	-	40	38	16	36	24	25	25	31	29	28	29
Area D	29	12	10	6	6	3	4	2	8	8	5	8
Area E	-	-	-	7	7	5	5	4	11	13	8	8
Area F	-	-	-	28	24	24	16	20	38	19	6	22
Area G	-	-	-	-	98	111	65	108	108	106	106	100
TOTAL	29	68	66	65	179	173	119	165	211	193	183	180

Table 2.4.5. Commercial clam licences issued, 1990 to 2000.

		1990	1991	1992	1993	1994	1995	1996	1997	1998*	1999*	2000*	Ave 90-97
Area A	North Coast	69	28	10	11	26	-	1	2	-	-	6	18
Area B	Johnstone Strait	426	323	263	314	317	491	427	265	353.25	79	82	353
Area C	Sunshine Coast	184	198	173	199	110	144	145	149	162.75	150	172	163
Area D	Upper Strait of Georgia	516	598	436	533	568	714	405	503	534.13	196	174	534
Area E	Lower Strait of Georgia	440	365	587	387	475	441	343	216	406.75	190	181	407
Area F	West Coast Vancouver Is.	433	331	269	134	267	538	494	346	351.5	242	255	352
Area G	Queen Charlotte Strait	0	65	76	61	81	120	91	91	73.125	50	51	73
TOTAL		2068	1908	1814	1639	1844	2448	1906	1572	907	916	921	1900

* Note: 1998 - 2000 values are preliminary, north coast landings are not complete for 1996 .

Table 2.4.6. Depurated clam landings 1990 to 2000: total landings for beaches allocated to the depuration fishery (calendar year)

LANDINGS IN POUNDS

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Manila	57,099	-	141,447	325,002	216,844	424,275	878,857	897,272	881,840	801,423	651,615
Littleneck	199,913	241,432	266,051	284,856	189,331	159,966	32,297	66,138	88,184	61,592	104,039
Total (lbs)	257,012	241,432	407,498	609,858	406,176	584,241	911,155	963,410	970,024	863,015	755,654

LANDINGS IN TONNES

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Manila	26	-	64	147	98	192	399	407	400	363	296
Littleneck	91	110	121	129	86	73	15	30	40	28	47
Total (t)	117	110	185	277	184	265	413	437	440	391	343

Note: 1996 includes 190.47t of clams depurated from oyster tenure included in wild fishery landings.

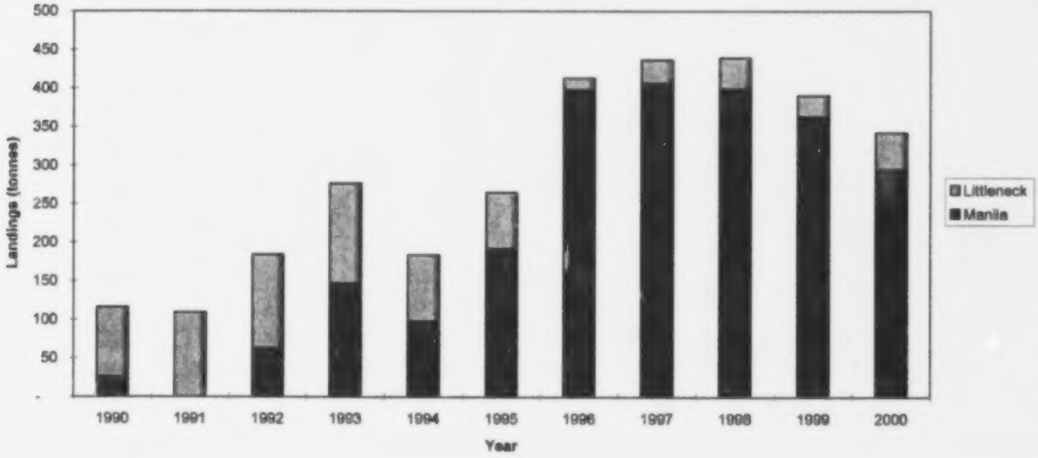

Figure 2.4.3. Depurated clam total annual landings (tonnes), 1990 to 2000.

Table 2.4.7. Estimated landed value ($000) of the commercial clam fishery, 1990-2000.

AREA	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
B	-	$ 572	$ 485	$ 431	$ 605	$ 525	$ 469	$ 351	$ 333	$ 429	$ 618
C	-	$ 300	$ 301	$ 371	$ 648	$ 748	$ 825	$ 1,061	$ 1,237	$ 1,221	$ 1,101
D	$ 1,500	$ 1,172	$ 1,041	$ 750	$ 898	$ 527	$ 535	$ 250	$ 635	$ 569	$ 422
E	-	-	-	$ 563	$ 897	$ 501	$ 525	$ 367	$ 578	$ 716	$ 516
F	-	-	-	$ 714	$ 744	$ 1,131	$ 956	$ 1,024	$ 1,106	$ 602	$ 281
G	-	-	-	-	$ 142	$ 126	$ 132	$ 198	$ 90	$ 221	$ 191
Depuration	-	-	-	-	-	-	-	-	$ 1,232	$ 1,096	$ 960
Heiltsuk Fishery	-	-	-	-	-	-	-	-	-	$ 276	$ 343
Razor Clams	$ 130	$ 129	$ 82	$ 67	$ 186	$ 231	$ 137	$ 200	$ 79	$ 146	$ 464
Total	**$ 1,630**	**$ 2,172**	**$ 1,909**	**$ 2,895**	**$ 4,120**	**$ 3,790**	**$ 3,578**	**$ 3,451**	**$ 5,291**	**$ 5,276**	**$ 4,896**

Note: Average price per lb. of clams from 1990 - 1997 is estimated at 1.50 although it has fluctuated from $1.25 to $2.00

Average price 1998 - $1.67, 1999 - $1.76 and 2000 - $1.73

Note: Area B and G littleneck price @$1.00 and butter clam @$.45

Note: 2000 values are preliminary

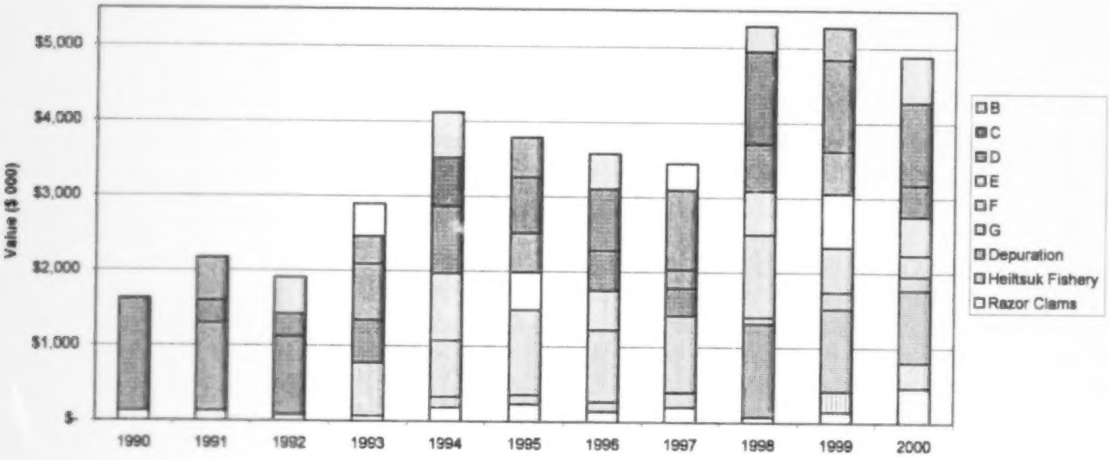

Figure 2.4.4. Estimated landed value ($000) of the commercial clam fishery by Clam Management Area, 1990 to 2000.

Table 2.4.8. Estimated average earnings per licence in South Coast areas, 1990 to 2000.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Area B	-	1,769	1,842	1,371	1,909	1,070	1,097	1,325	943	5,426	7,542
Area C	-	1,515	1,741	1,862	5,891	5,194	5,688	7,121	7,601	8,143	6,399
Area D	2,907	1,959	2,388	1,407	1,581	738	1,322	498	1,190	2,901	2,427
Area E	-	-	-	1,453	1,888	1,137	1,531	1,697	1,422	3,769	2,849
Area F	-	-	-	5,331	2,785	2,102	1,935	2,959	3,147	2,486	1,102
Area G		-	-	-	1,755	1,048	1,447	2,177	1,236	4,425	3,747

Note: These values are generated using the number of licenses issued not the number of diggers actually fishing

Note: 1999 and 2000 values are preliminary

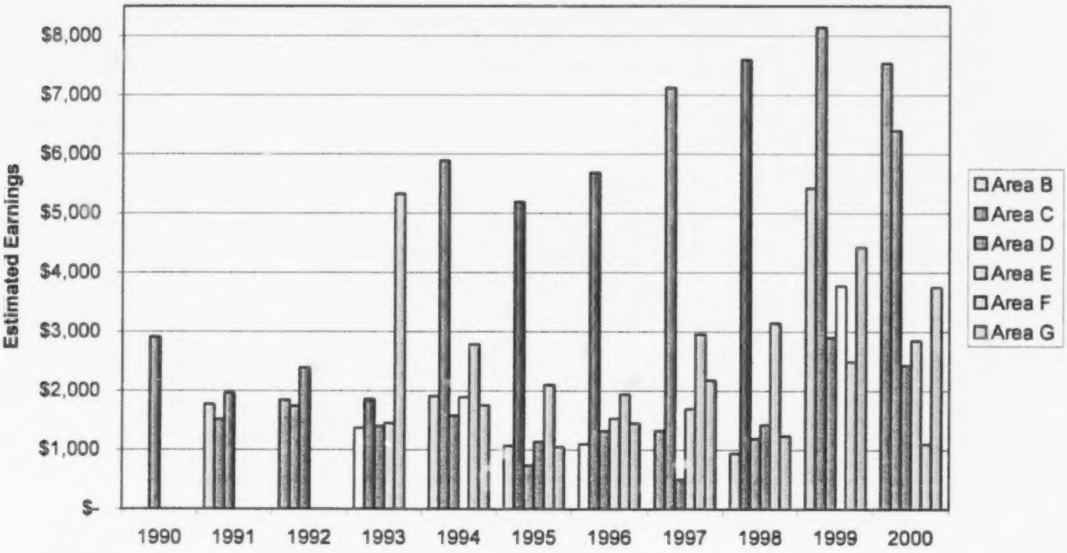

Figure 2.4.5. Estimated average earnings per licence in South Coast areas, 1990 to 2000.

2.5. Opal Squid Fishery – J. Morrison and E. Wylie

This document summarizes the present and historical information regarding the development of the opal squid fishery on Canada's west coast. It includes complete information up to and including the year 2000, and partial information about the structure of the fishery, management actions and changes in the year 2001. The catch information for the year 2000 is considered to be preliminary, as records continue to be audited and corrected.

2.5.1. Introduction

Opal squid (*Loligo opalescens*) are one of 17 species of squid that occur in Canada's Pacific coastal waters. They are found from the southern Gulf of Alaska to Mexico and are most frequent off the coast of Oregon and California. They are found from the intertidal zone to 250 m depth. They weigh 14 to 70 gm (2.5 oz). A category Z-E squid license is required to participate in the commercial fishery. Opal squid are largely taken by seine. Hook and line and side catcher or frame nets may also be used, but are not common. Commercial fishers opportunistically fish opal squid when the squid appear in concentrations, either feeding, spawning, or attracted to lights. Effort is usually incidental to other fisheries, rather than directed. Squid landed in British Columbia are mainly used at present as bait in the crab, sablefish and halibut fisheries. There is interest in marketing squid as food, however the large California squid fishery produces a low priced food product making it difficult for B.C. squid to compete in this market. There is no information about recreational and First Nations' fishing practices or patterns fishing on opal squid.

2.5.2. Fishery Management Objectives

No specific management objectives have been described specifically for this fishery. General management goals and objectives for all invertebrate fisheries are listed in section 1.0.

2.5.3. Commercial Fishery Management Actions

The squid management plan is reviewed annually and prepared in November. The commercial fishery requires an annual "Z-E" licence to harvest squid by seine, trawl, frame net or hook and line. This is a personal licence designated to a fishing vessel. Entry is unlimited. This fishery is closed by regulation January 1 to December 31 and areas are open by Variation Order upon request to a fishery manager or fishery biologist. Permanent area closures described in the management plan have not changed in any substantive manner for the past 5 years. Submission of logbooks and fish slips is required as a condition of licence.

2.5.4. Commercial Catch and Effort

Commercial catch and effort information for the years 1984 through 2000 is summarized in Table 2.5.1. Information considered to be confidential is obscured in the tables, when less than 3 vessels report fishing activity in a year. Landings of opal squid have declined in recent years. Landings in 1997, 1999 and 2000 were less than 10 t. The reasons for the decline in participation from 1997 to 2000 are unknown. Participation and landings was also low in 2001, attributable to the delays in commencement of the fishery until April following a protracted Department discussion on the continuance of the fishery. Table 2.5.2 provides a summary of opal squid landings by year and area, as reported on fish slips. The accuracy of fish slip information is questionable. A table typical of fishery updates, reporting landings by fishery management area and month for the reporting year (2000), is not included in this report. With only 1 vessel reporting catch, all distributional information for the year of record is considered to be confidential.

Landing weight and the pattern of fishing distribution are not considered to be in any way indicative of opal squid stock strength or of distribution. The landed value information is of questionable accuracy as numbers may be distorted by landings retained for bait and unreported, or reported to be of low or no value.

2.5.5. Stock Assessment Activities

The Shellfish Data Unit collect and process harvest log information for the opal squid fishery. A stock status report has previously been prepared for this species. Commencing in 2001, fishers were required by condition of licence to provide a 10 kg sample of squid to staff at the Pacific Biological Station. These samples are intended to confirm the species harvested, and provide information about sized and sex of stocks exposed to harvesting. Three samples were received in 2001.

2.5.6. Enforcement Concerns

Enforcement in this fishery is on an opportunistic basis. Poor compliance with hail, logbook and fish slip reporting requirements are of concern.

2.5.7. Industry and Stakeholders

There is no formal advisory committee established for this fishery. No specific concerns have been identified to DFO by fishers, buyers, processors, First Nations or other stakeholders. The last meeting with licence holders and stakeholders was held in the fall of 2000, with limited attendance. The draft fishing plan is mailed out to all licence holders and coastal First Nations, including an offer to meet if there was sufficient interest. No requests for a meeting this year were forthcoming.

2.5.8. Recent Changes in the Fishery

The commercial fishery commenced in April, 2001, due to a protracted review by the Department. Vessel hails were altered in 2001 to conform to new Department Area boundaries. Commencing in 2001, vessel masters were required to record additional information in logbooks about squid presence and distribution. Logbooks have not yet been inspected for compliance with this condition. Commencing in 2001, fishers were required to file "nil" logbook reports for months when no fishing occurred. Only 1 fisher complied, and all nil reports were received late in the year. Commencing in 2000, fishers were requested to provide opal squid samples to the Department, Invertebrate Stock Assessment Division. No samples were received. Commencing in 2001, fishers were required to provide, a 10 kg. sample of opal squid from each Subarea in which they fished and retained catch. 3 samples were received. Commencing in 2001, fishers were recommended to arrange for 3rd party on-board observers to record characteristics of bycatch. This did not occur. Commencing in 2000, fishers were urged to consider preparation of a code of good practice for this fishery. There has been no interest or progress on this topic.

2.5.9. Priority Issues

- Landings are likely under-reported or not reported at all, as fishers have little incentive to report catch. Much of the catch is landed for personal use as bait.
- Squid licences are unlimited. As many licences are issued as are requested annually. Although not of concern as long as market values are low and interest is limited, any unexpected increase in effort would not necessarily be detected by managers in a timely manner, nor is there a mechanism in place to limit effort.
- There is no information on the size of squid stocks on the coast, and accordingly no estimate of what may constitute a sustainable fishery.
- There is no information about bycatch from this fishery. Bycatch of herring is known to occur, as fishers have reported ways of limiting bycatch impacts by spilling (releasing)

their catch. As fishing is sporadic and opportunistic, often in remote locations, it is not considered to be suitable for a highly structured observer program.

- Seine gear can impact the bottom when fishing for squid, particularly if fishers are targeting spawning aggregations in shallow waters. Gear may also remove or damage squid egg masses.

2.5.10. References Cited and Sources of Additional Information

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Table 2.5.1. Squid landings, value and effort, as reported on fish slips and harvest logs, 1984 to 2000.

Year	No. licenses issued	No. licenses with fish slips	No. licenses with logs	Fishing days on slips	Fishing days on logs	Total Landings (t) slips	Total Landings (t) logs	Landed Value ($\$\cdot 10^3$) slips	Landed Value ($\$\cdot Kg^{-1}$)	CPUE (t/day) slips	CPUE (t/day) logs
1984		26	14	N/A	177	69	75	25	0.36	n/a	0.4
1985		24	12	274	89	111	86	184	1.66	0.4	1.0
1986		18	10	288	118	89	87	127	1.43	0.3	0.7
1987		8	7	123	80	86	85	132	1.53	0.7	1.1
1988		8	8	98	80	88	88	113	1.28	0.9	1.1
1989		7	5	56	53	70	43	94	1.34	1.3	0.8
1990		9	8	115	64	72	49	81	1.13	0.6	0.8
1991		9	9	65	72	116	107	148	1.28	1.8	1.5
1992	47	5	5	77	60	93	72	135	1.46	1.2	1.2
1993	47	7	4	32	54	13	16	17	1.30	0.4	0.3
1994	46	7	7	155	96	175	116	199	1.14	1.1	1.2
1995	81	9	9	274	106	76	65	95	1.25	0.3	0.6
1996	107	17	16	377	176	78	70	97	1.25	0.2	0.4
1997	55	2	4	9	46	#	#	#	1.43	0.7	0.1
1998	86	4	5	44	71	22	23	44	2.05	0.5	0.3
1999	37	2	3	42	32	#	#	#	2.08	0.2	0.3
2000	14	1	1	5	8	#	#	#	2.76	0.2	0.9

# Confidential data, Less than 3 vessels

Table 2.5.2. Summary of squid landings (tonnes) by year and management area, all gear, as reported on fish slips, 1987 to 2000.

	TOTALS					Northern Waters, PFMAs 1 to 10										
	Total Coast	Northern waters	Southern waters	East coast Van. Isl.	West coast Van. Isl.											
	(t)	(t)	(t)	(t)	(t)	1	2E	2W	3	4	5	6	7	8	9	10
1987	85.8	0.3	85.5	0.2	85.3	0.3							0.0			
1988	88.3	2.9	85.4	0.0	85.4	0.2		0.1						0.8	1.9	
1989	69.8	8.8	61.0		60.5								8.8			
1990	72.0	0.6	71.5		70.8			0.6								
1991	116.0	0.0	116.0		114.7											
1992	92.6	0.0	92.6		92.4											
1993	11.1	0.1	11.0	0.4	10.6					0.0	0.0					
1994	175.1	7.3	167.8	0.7	167.1		0.1			0.0			7.1	0.1		
1995	75.7	42.0	33.7	4.7	29.0	0.5	0.0	4.0					7.5	20.3	9.7	
1996	77.7	27.0	50.7	5.9	44.8	5.0		1.2	0.1				4.0	2.9	13.8	
1997	#	#	#	#	0.0								#	#		
1998	16.1	14.9	1.2	1.2	0.0		#						#	#		
1999	#	#	#	0.0	#		#									
2000	#	#	#	0.0	#								#			

	Southern Waters, PFMAs 11 to 27																	
	East Coast Vancouver Island											West Coast Vancouver Island						
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27
1987		0.2		0.0				0.0	0.0			0.1		67.2	18.1			
1988														85.4				
1989			0.5						0.0					60.5				
1990		0.2		0.0				0.3	0.0	0.1	0.1			67.7	2.3			0.8
1991	0.4	0.3		0.5			0.0							99.6	15.1			
1992		0.2												92.4				
1993				0.1			0.0				0.2			10.6				
1994							0.7							166.8	0.2	0.0	0.0	
1995	0.0	0.0							4.6			0.0	0.0	28.0	0.8	0.1	0.0	0.0
1996							0.1		5.7					44.8	0.0			
1997		#																
1998		#																
1999														#				
2000																		#

# Confidential data is obscured
0.0 = catch reported less than 50 kg.
Data reported for a Pacific Fishery Management Area 1 - 27, may include data for adjacent offshore waters in PFMA 101 - 127

2.6. Octopus by Dive Experimental Fishery – E. Wylie

2.6.1. Introduction

This report presents an overview of the 2000 experimental octopus fishery. It also includes by-catch information from other trap and trawl fisheries. The recreational and aboriginal effort for octopus is thought to be low and no information is available on the harvest characteristics of these sectors. This octopus update includes detailed landing data from the 2000 experimental season, which ran from January 2000 to December 2000, and annual historic commercial data.

2.6.2. Overview

Octopus are landed by divers and as a bycatch in the trap and trawl fisheries (directed trap licences were discontinued in 1999). In some years, the amount incidentally caught by trawls and traps has surpassed the landings by dive. Historically, octopus landed in British Columbia have been primarily utilized as bait in other fisheries such as the halibut fishery. More recently there have been attempts to organize the fishery in order to fill European and Asian market demands for food quality octopus. The introduction of the IVQ (individual vessel quota) in the halibut fishery created less of a demand for octopus as bait. Halibut fishers now make greater use of bycatch such as pink salmon and other lower priced bait rather than octopus (B. Ackerman, personal communication).

The total landings have fluctuated between approximately 200 t for the years 1988 to 1990 to below 100 t in the mid 90's back to landings above 200 t in '97 (Table 2.6.1). The landings have declined since 1997 to 55 tonnes in 1999. These fluctuations are likely due to market changes and not fluctuations in stock strength. The octopus landings in 2000, totalling all gear types, was 59 t as recorded by sales slips.

In the dive fishery, octopus are harvested by SCUBA divers who swim along rocky shelves, reefs or the ocean floor in search of dens. Certain dens are "good producers" and may contain an octopus every time a diver visits. When an octopus is discovered in a den, the diver drives it out using an irritating substance and captures it in a net or bag. Harvesters are not permitted to use deleterious substances as an irritant and are not permitted to use sharp implements to harvest octopus.

The directed octopus dive fishery in British Columbia is regarded as a data limited fishery, as little is known about the biology or population responses of octopus to fishing. As such, the phased approach for new and developing fisheries has been applied (section 2.6.3). As a result of adopting a phased approach, the issuance of the octopus dive ("Z-G") licences was discontinued in 2000 and an experimental fishery was initiated under the authority of personal, vessel-based scientific licences. This change gave the Department more flexibility with respect to regulations, licence conditions and enforcement, and provided a vehicle for octopus harvesters to collect more detailed biological data with respect to this species while undertaking commercial harvest. Area based scientific licences have been limited to those fishermen with a landing history in the octopus dive fishery (section 2.6.3.1). Expansion of the fishery is not being considered until assessment and management frameworks for octopus can be developed and a proven acceptable environmentally benign irritant for use in harvest has been identified. Fisheries and Oceans is concerned about the known use of bleach as an irritant in this fishery. Bleach is considered a deleterious substance and under the Fisheries Act which is prohibited. As part of the experimental fishery fishermen must find an acceptable irritant for use in this fishery.

2.6.3. Experimental Fishery

In November 1999, the Minister of Fisheries and Oceans Canada announced management and licensing changes to the octopus fisheries in response to the need for a more precautionary and phased approach to developing this fishery. Within the Stock Assessment Division of DFO, a framework was developed for the provision of scientific advice for the management of new and developing invertebrate fisheries, including established fisheries whose expansion is limited due to a lack of information of the species distribution or abundance (Perry *et al.* 1996). This framework included three phases for the precautionary development of a fishery:

> Phase 0: Collection of all available information on the target species, and from similar species elsewhere, to provide a baseline with which to advise on the alternative management options and to identify areas where information is lacking;
> Phase 1: Involves surveys and experimental fishing where the objective is the collection of data required to fill in the information gaps identified in the first phase and to explore the fishery potential.
> Phase 2: Fishing for Commerce. A fishery is developed at the commercial level, while stocks are monitored and management strategies are evaluated.

Following this approach information that will lead to a biologically-based management plan is collected through an experimental approach to the fishery. Only after a biologically-based management plan is developed is a fully licensed directed commercial fishery on that species initiated.

A phase 0 paper was written (Gillespie 1998) even though the octopus fishery was already developed. Its objectives were:

1. To complete a literature search to gather and synthesize all available information on the biology, behaviour and ecology of *Octopus doling*;
2. To critically review available information on British Columbia octopus fisheries;
3. To review fisheries for *Octopus doling* and major fisheries for other octopus elsewhere in the world;
4. To provide a focus for discussion of current octopus fishery issues; and
5. To provide recommendations and advice to senior managers for the rational management of the directed dive fishery, bycatch fisheries and developing pot fisheries for *Octopus doling* in British Columbia.

2.6.3.1. Participants

In 2000, licence issuance was limited to fishermen who had a landing history of 10,000 pounds between 1995 and 1999. There were sixteen experimental dive licences issued, and twelve of these licence holders recorded landings (Table 2.6.1). First Nations did not hold any octopus by dive licences.

A Tidal Water Sport Fishing Licence is required for the recreational harvest of octopus. The daily sport limit for octopus is 1 animal, with a possession limit of 2. Effort in this recreational fishery is thought to be very low.

2.6.3.2. Location of the fishery

The octopus by dive fishery occurs primarily in south coast areas, with the majority of octopus landed by divers from the areas along the East Coast of Vancouver Island from Port Hardy to Sooke (Areas 12 to 20). Reported landings of octopus by divers from areas on the West Coast of Vancouver Island and the North Coast of BC have been relatively minor, Table 2.6.2.(all gears) and Table 2.6.3.(dive only). The incidental landings from the trap trawl fisheries occur all over the coast wherever trap and trawl fishing occurs.

Prior to the initiation of the experimental fishery fishermen could fish anywhere on the coast with one licence. With the setup of the experimental fishery the coast was split into three areas in which fishermen had to choose one. The areas are the North Coast (Areas 1-10), the Southern Inside (Areas 11-19, 28 and 29) and West Coast (20-27).

Average annual maximum harvest depth per dive increased during the initial years of the fishery from 13.4 m (44 ft.) in 1983, to 18.6 m (61 ft.) in 1986. Since 1986 maximum depth has remained relatively stable with the exception of years following peak harvest, 1988 and 1994. During these periods harvesters dove to an average maximum depth of 20.7 m (68 ft.) and 20.4 m (67 ft.) respectively.

2.6.3.3. Time frame

The Octopus dive fishery is open all year, based on the calendar year (January – December). The fisheries that land octopus as by-catch are only allowed to catch these animals during the open times of their directed fishery. Consistent with earlier years, dive landings occurred throughout all months in 2000, in order to provide a continuous supply of product to a relatively small market.

2.6.3.4. Landings/Value/Markets

The average whole landed value for octopus by dive gear in 2000 was $4.41/kg, and $3.18/kg for the trawl and trap fisheries (Table 2.6.1). Reported landings from sales slips indicate that the dive fishery was worth about approximately $69,100 in 2000, a decrease from the 1999 value of $132,700. The landings from trap and trawl gear increased in overall value from $60,000 in 1999 to $137,000 in 2000.

The reported annual landings of octopus from British Columbia fisheries have fluctuated widely. Prior to 1987, octopus landings averaged less than 22 tonnes annually, but increased noticeably between 1988 and 1990 to approximately 200 tonnes, in response to demands for octopus for use as bait in the halibut fishery. With the introduction of individual vessel quotas (IVQs) in the halibut fishery in 1991, the demand for octopus for bait declined, as halibut fishermen were able to obtain similar bait products from more competitive sources. In response to this, the landings of octopus by all gear types declined to a low of 81 tonnes in 1995. Since 1996, there has been some renewed interest in the octopus fishery as a result of developing markets for food quality products. Octopus landings by all gear types have increased substantially since 1996 and reached record levels of 220 tonnes in 1997. Since 1997 the landings declined to a low of 58 tonnes in 1999. In 2000 the landings by all gear types totalled 71 tonnes according to sales slips. This catch was comprised of 46 tonnes from the trap and trawl gear types and 25 from the experimental dive fishery

2.6.3.5. Consultative process

In 1997, industry divers created the Pacific Octopus Divers Society (PODS). The association represents many of the active octopus dive fishers. At least once a year, usually more, the Department meets with industry and any interested parties to discuss the fishery.

2.6.3.6. Management styles

(Commercial Fishery 1982-1999; Experimental harvest and assessment in 2000)

Prior to 1992 all octopus harvesting was conducted under a single category Z-J licence. In 1992, upon the advice of industry, separate licences were issued for octopus by dive (Z-G) and octopus by trap (Z-P). Harvest logs of fishing activity were required as a condition of both licenses. This allowed separation of the catch data according to gear type and development of a more meaningful catch database. While there have been a number of attempts to develop a directed trap fishery for octopus there has been little success to date. Most trap caught octopus have been reported as incidental catch in directed crab and prawn by trap fisheries. Octopus by trap licences were discontinued at the end of 1998. As such since 2000 the octopus by trap fishery has occurred only as an optional endorsement in the directed crab and prawn by trap fisheries.

Little is known of octopus biology and its' response to fishing pressure and as such the fishery was converted to an experimental fishery in 2000. Also of concern was the continued use of bleach in this fishery, which is prohibited under the Fisheries Act. The fishery was limited by a landing history and approximately 18 fishermen were eligible (section 2.6.3.1). An Area licence (section 6.3.2) was issued after the fishermen committed to completing biological information on their catch and agreed to discontinue using bleach.

2.6.3.7. Biology and Stock Status

The giant Pacific octopus (*Octopus doling*) is a large cephalopod mollusc distributed along the rocky areas of the Pacific coast from the intertidal zone to depths of over 100 m. Adult and juvenile octopus establish dens in caves, rocks or soft shell substrates. They are primarily nocturnal predators which feed on crabs, a variety of molluscs and small fish. Females brood their eggs on the ceiling of their dens. The young are planktonic and remain in the water column until they are 50 mm in length, at which point they descend to the bottom. Octopus mature in about 2-3 years, at a size of 12 kg for males and 20 kg for females. They may grow to 9 m in length, measured from tip of tentacle to tip of tentacle.

The Stock Status of the Giant Pacific Octopus is relatively unknown. At this time the biological response of fishing pressure is not known. One of the purposes of the experimental fishery is to determine means of stock assessment. Octopus is unlike any other harvested animal on the BC coast and the development of a suitable stock assessment strategy may prove to be very difficult.

2.6.4. Management Objectives

The specific management objectives for the Octopus fishery:

1. Develop research and stock assessment programs to ensure sustainability of octopus stocks.
2. Restrict expansion of fishing activity until the status and condition of stocks are appraised.
3. Establish closed areas within all current commercial fishing areas to ensure protection of local populations.

2.6.5. Fishery Management Actions

Management of this fishery to the end of 1999 has been restricted to area closures, collection of harvest logbook information, and limiting tools and equipment used for collection. Park, research areas, and ecological reserve closures are described in the Octopus by Dive Management Plan. Daily harvest logs and sales slips are required as a condition of licences. The directed trap fishery was discontinued in 1999. Incidental octopus catch is permitted in the prawn and crab trap fisheries and trawl fisheries. As a result, outside of the dive fishery, which is open all year, fishing opportunity varies in conjunction with other fishery openings.

In 2000, the management actions prior to the experimental fishery continued from the previous year and included a more comprehensive biological log, licence limitation through a landing history and commitment to using environmentally benign irritants. In 2000 the shrimp trawl fishery was open throughout the year, with closures occurring as shrimp quotas were obtained (See the shrimp trawl update for details). The prawn fishery opened on May 5 and closed in season as the prawn trap fishery closures were put in place. A coast wide closure for prawn was implemented July 28/00 (see the prawn update).

2.6.6. Catch and Effort

2.6.6.1. Landings

Landings of octopus increased substantially between 1985 and 1989 from 33 t to 216 t but declined to 89 tonnes in 1994 (Table 2.6.1.). Prior to 1991, 70 to 80% of the annual landings were from the dive fishery and about 10% were reported as incidental catch from trap fisheries. Declining annual catch since 1991 has largely been the result of declining catches in the dive fishery, where landings fell from a high of 154 t in 1990 to 47 t in 1995. Trap caught octopus landings increased from about 20 tonnes in 1990 to a peak of 72 tonnes in 1997.

The majority of octopus landings occur in south coast areas. In 2000 most of the catch was reported from areas 12, 13, 17 and 18, similar catch distribution to previous years (Table 2.6.2.). Annual landings of octopus, from slips in 2000 were 59 t, of which 16 t were from the dive fishery, remainder from the trawl, trap and miscellaneous fisheries. However, the dive logbooks indicate 25 tonnes were landed in 2000. 2000 saw a decrease in catch from the 1999 levels which may be due to the initiation of the experimental fishery.

2.6.6.2. Effort

In 1999, 44 dive licences were issued with 16 licences active. There were 81 trap and trawl vessels with landings in 1999. In 2000 the experimental fishery was initiated. 16 experimental dive licences were issued with 12 reporting landings. 113 trap and trawl vessels recorded landings.

Effort (vessel days from sales slips) decreased by more than half between 1999 and 2000. It is likely that some of the decrease is due to the added requirements of the experimental fishery but the majority is likely due to market conditions. The majority of octopus dive fishermen participate in other fisheries which also may have taken priority in 2000. The trap and trawl effort however increased dramatically from 1,856 days to 5,112 days in 2000 but the average days fished over the years is up over 6,000 days (Table 2.6.1). The low numbers in 1999 is likely due to the discontinuation of the directed octopus trap fishery and new requirements with the other trap fisheries. The prawn and crab trap directed fisheries were required to obtain special conditions of licence starting in 1999 in order to retain octopus.

2.6.6.3. CPUE

Harvest information for catch and effort calculations from the dive fishery are obtained from commercial harvest logs. Catch per diver hour, since the splitting of the licence in 1991, has averaged 132 lbs./hour. The range is between 107 and 160 lbs./hour. In 2000 we see the highest recorded catch per unit effort at 160 lbs./hour. This could largely be due to the fact that the experimental fishery was limited to experienced harvesters only. In this fishery it is important to note that using CPUE as an indication of stock strength may not be appropriate do to the fact the fishery is highly motivated by markets.

Catch and effort calculation can not accurately be completed for the trap and trawl fisheries. Current logs provide only an indication of catch.

Although fishing effort occurs primarily during fall and winter, monthly CPUE rates do not vary considerably by season. Monthly averages calculated show only a small decrease during late spring and early summer.

2.6.7. Stock Assessment Activities

The Shellfish Data Unit collected and processed biological harvest log information for octopus dive and harvest logs from the trap fisheries in 2000.

2.6.8. Enforcement Concerns

Although landings have been reported from the hook and line fisheries, this method of harvesting is illegal. There is no directed enforcement attention to this fishery. Fisheries and Oceans is concerned about the known use of bleach as an irritant in this fishery. This is an ongoing enforcement concern that is difficult to prosecute.

2.6.9. Priority Issues

- At present there is little information available on these stocks and as such there is no plans to expand the fishery until a comprehensive stock assessment program can be developed to ensure conservation.
- The DFO will be trying to work with individuals in the octopus fishery to consult on areas within south coast commercial fishing grounds that will be closed to commercial fishing. These areas will act as refugia for a portion of the population and will help protect against over exploitation of individual stocks.
- Irritants used during the beginning of the experimental fishery need to be analysed for effectiveness and cost. If the new substance is either costly or not as effective as bleach the use of it will be in doubt. Concerns with the use of chemicals (bleach solutions) to harvest octopus by diving were identified in 1993. This is illegal under the Fisheries Act.

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Table 2.6.1. Octopus landings, value and effort as reported on sales slips and harvest logs, 1985 to 2000.

Year		No. licences issued	No. vessels with landings (logs)	No. vessels with landings (slips)	Fishing days (slips)	Total Landings (t) (logs)	Total Landings (t) (slips)	Landed Value (\$$10^3$) (Slips)	Whole Landed Value (\$ / kg) (Slips)	CPUE (tonnes/ vessel Day) (Slips)
1985			66	118	1,809	25	33	78	\$ 2.38	
1986			76	129	1,799	47	52	133	\$ 2.56	
1987			94	148	3,497	105	130	381	\$ 2.92	
1988			113	147	4,398	192	209	649	\$ 3.11	
1989			124	170	4,464	192	216	705	\$ 3.26	
1990			169	177	4,601	236	197	657	\$ 3.34	
1991			143	179	4,956	89	131	414	\$ 3.16	
1992	Trap & trawl[1]		114	128	4,161	49	47	114	\$ 2.44	
	Dive	73	19	36	908	46	70	233	\$ 3.36	0.08
1993	Trap & trawl[1]		132	133	5,629	78	77	199	\$ 2.58	
	Dive	71	17	21	539	67	68	242	\$ 3.58	0.13
1994	Trap & trawl[1]		139	132	6,732	45	43	99	\$ 2.31	
	Dive	62	16	28	795	49	46	162	\$ 3.56	0.06
1995	Trap & trawl[1]		139	165	5,371	35	41	113	\$ 2.76	
	Dive	57	19	26	478	48	54	204	\$ 3.80	0.11
1996	Trap & trawl[1]		224	158	8,762	76	134	481	\$ 3.59	
	Dive	64	27	35	815	76	74	276	\$ 3.73	0.09
1997	Trap & trawl[1]		242	174	8,101	100	110	363	\$ 3.29	
	Dive	77	35	43	1,034	120	112	475	\$ 4.25	0.11
1998	Trap & trawl[1]		228	164	7,355	73	86	265	\$ 3.08	
	Dive	66	20	21	478	61	61	251	\$ 4.10	0.13
1999	Trap & trawl[1]		81	69	1,856	22	25	60	\$ 2.40	
	Dive	40	15	16	331	36	30	133	\$ 4.41	0.09
2000*	Trap & trawl[1]		64	113	5,112	46	43	137	\$ 3.18	
	Dive	16	12	12	129	25	16	69	\$ 4.41	0.12

[1] Trap and trawl includes shrimp trawl, mid water trawl, other trawl, shrimp trap, crab trap and other trap.
Landings from the Groundfish fishery include both landed and discarded.
The groundfish fishery does not use slips for value info so value was extrapolated.

* Commercial licence discontinued. Beginning of experimental dive fishery.

Notes 1999 and 2000 data area still considered preliminary.
Prior to 1992 all octopus harvesting was conducted under one licence, Z-J.
Other than the trap fishery octopus is a bycatch and separte licences were not issued.
In 1999 the octopus by trap licence was discontinued.
Shrimp by trap fishers were not required to hold a licence to land and report octopus in 1995.

Table 2.6.2. Summary of octopus landings in pounds, all gear types, by year and area, as reported on sales slips.

	NORTH COAST MANAGEMENT AREAS													TOTALS		
	1	2E	2W	3	4	5	6	7	8	9	10	North Coast (t)	South Coast (t)	Total Coast (t)	ECVI (t)	WCVI (t)
1984	923	4,511	337	1,044	4,529	9,033	2,992	0	590	0	224	24,183	30,217	54,400	24,487	5,730
1985	933	2,505	0	1,195	4,490	4,232	2,473	1,318	1,465	215	0	18,826	53,409	72,235	40,133	13,276
1986	386	4,780	14	108	3,466	2,432	500	35	3,808	0	1,040	16,569	97,766	114,335	73,903	23,863
1987	445	6,066	736	957	8,780	27,384	4,218	2,940	7,984	536	1,260	61,306	225,994	287,300	181,595	44,399
1988	8,148	12,583	0	1,358	9,845	28,613	6,319	4,499	15,114	970	1,694	89,143	370,988	460,131	301,926	69,062
1989	1,591	9,154	0	973	14,768	26,739	4,455	4,984	7,808	1,307	2,107	73,886	399,294	473,180	334,831	64,463
1990	1,576	17,028	144	1,668	12,708	33,914	2,432	2,827	1,889	1,552	2,189	77,927	355,286	433,213	272,106	83,180
1991	5,972	8,438	0	6,912	17,275	33,655	6,786	6,356	3,159	1,470	7,744	97,767	190,280	288,047	146,637	43,643
1992	6,258	3,989	229	3,914	8,808	15,551	6,468	13,999	3,773	4,500	1,804	69,293	187,016	256,309	124,508	62,508
1993	4,522	11,366	200	1,070	14,795	38,352	15,760	21,483	3,253	2,223	1,944	114,968	204,410	319,378	165,641	38,769
1994	3,688	6,539	0	3,490	8,535	15,911	17,214	8,439	3,135	2,477	3,419	72,847	121,548	194,395	97,390	24,158
1995	1,117	7,384	8	5,762	12,550	19,406	7,630	6,171	1,816	3,836	1,632	67,312	141,096	208,408	117,288	23,808
1996	64	3,871	112	15,212	11,276	53,647	49,573	25,213	14,910	10,835	2,971	187,684	245,976	433,660	205,327	40,649
1997	6,586	2,054	0	9,981	31,743	10,208	13,306	13,618	12,713	11,958	3,483	115,650	341,768	457,418	295,893	45,875
1998	442	3,250	148	4,484	9,661	12,842	11,013	16,051	5,830	7,852	3,520	75,093	229,640	304,733	208,215	21,425
1999	0	306	0	2,225	835	4,866	1,852	1,678	1,708	1,734	4,341	19,545	82,438	101,983	80,038	2,400
2000	607	678		3,994	3,923	1,593	4,183	4,324	3,696	3,227	289	26,512	75,887	102,399	70,975	4,913

SOUTH COAST MANAGEMENT AREAS

	East Coast Vancouver Island											West Coast Vancouver Island						
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27
1984	1,187	923	4,867	249	190	39	310	4,035	12,606	0	81	4,589	152	488	339	85	24	53
1985	1,036	3,704	6,824	1,708	146	88	1,341	8,085	16,776	195	228	10,583	323	1,432	771	20	0	147
1986	1,642	9,069	9,290	1,004	1,040	1,990	15,164	11,204	22,725	210	565	13,880	1,151	2,164	3,339	719	1,617	993
1987	1,743	39,191	31,253	2,194	658	1,997	15,794	20,672	63,282	1,388	3,423	19,623	242	9,705	13,987	207	428	207
1988	2,593	90,326	45,425	3,717	3,365	316	17,130	26,747	109,264	772	2,271	16,658	177	6,705	22,253	592	118	22,559
1989	1,603	93,728	38,003	8,178	2,328	2,836	29,223	75,150	81,933	122	1,727	15,403		12,811	23,871	10,201	1,713	464
1990	2,490	115,508	14,143	1,798	6,588	8,140	15,525	38,571	65,645	264	3,434	28,007	3,946	19,652	23,770	2,679	2,710	2,416
1991	3,329	62,425	15,355	942	3,120	2,761	13,836	17,550	25,352	80	1,887	8,615		11,221	15,268	2,481	2,645	3,413
1992	3,782	30,543	17,000	3,736	3,162	1,713	19,087	12,532	31,865	15	1,073	21,594	888	3,433	24,838	626	5,576	5,553
1993	7,730	38,492	20,089	4,093	1,763	5,756	22,447	23,102	41,240	84	845	5,197	1,684	5,399	13,841	2,034	8,848	1,766
1994	4,809	28,058	8,462	3,163	955	3,318	11,584	11,774	22,785	30	2,452	3,351	975	4,534	9,476	479	3,169	2,174
1995	9,452	54,843	8,770	8,484	675	1,162	14,818	5,257	11,763	1,043	1,021	3,589	20	2,915	9,032	1,547	2,630	4,075
1996	10,713	114,371	8,989	1,488	2,865	2,250	18,560	22,283	19,313	3,386	1,109	9,390	0	2,327	17,564	2,283	2,220	6,865
1997	11,538	136,122	18,515	8,699	7,678	7,756	13,379	29,030	48,842	1,064	13,270	11,464	557	5,819	16,205	4,311	3,614	3,905
1998	11,310	125,665	8,330	7,174	5,225	8,690	9,469	14,887	13,704	1,388	2,373	9,259	682	852	6,145	1,720	440	2,327
1999	2,325	51,184	9,335	1,930	247	573	1,810	3,881	8,416	47	292	1,359	125	64	778	0	74	0
2000	1,439	31,043	10,802	4,058	7,562	1,890	4,745	5,620	748	714	2,355	127		539	2,511	201	18	1,518

Note – sales slips not available for groundfish trawl octopus bycatch

Table 2.6.3. Summary of octopus landings in pounds, dive gear only, by year and area, as reported on sales slips.

	NORTH COAST MANAGEMENT AREAS											TOTALS			
	1	2E	2W	3	4	5	6	7	8	9	10	North Coast (t)	South Coast (t)	Total Coast (t)	ECVI (t)	WCVI (t)
1984				#	#	3,369	#					4,304	23,815	28,119	18,948	4,867
1985	#	#			#	#	#					2,042	41,304	43,346	31,549	9,755
1986	#	#			#		#					2,746	85,138	87,884	65,694	19,444
1987			#	#	#	#	#					2,548	207,858	210,406	166,766	41,092
1988	#					#	#					10,838	343,610	354,448	279,513	64,097
1989	1,256			486		#	#					5,836	371,385	377,221	315,855	55,530
1990		#	#		#	#						#	310,385	310,790	242,621	67,764
1991		#		#	#	1,790	#	#			#	9,701	145,050	154,751	115,807	29,243
1992	#				#	#	3,069	#				13,601	139,576	153,177	96,243	43,333
1993					#					#	#	1,783	147,218	149,001	128,083	19,135
1994				#		#	4,518	#		#		11,290	89,160	100,450	76,754	12,406
1995	#			#		#	1,177					7,426	110,805	118,231	100,282	10,523
1996		#		#	3,240	9,188	5,737	#				20,382	143,060	163,442	115,465	27,595
1997		#		#	25,169	7,211	#					33,071	213,447	246,518	187,617	25,830
1998				#	5,123	3,735				#		11,551	123,583	135,134	111,061	12,522
1999				#	#	#						#	61,022	66,444	58,884	2,138
2000				#	#				#			#	32,823	34,540	30,438	#

SOUTH COAST MANAGEMENT AREAS

	East Coast Vancouver Island											West Coast Vancouver Island						
	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27
1984	#	169	2,917			#	#	3,250	12,028			4,486		#	#	#		
1985		1,282	4,950	1,528			870	7,016	15,903			9,583		#	#			
1986		6,318	8,963	974	#	#	14,988	10,344	21,207	#	#	12,811	#	#	3,056	#	#	#
1987		34,951	30,645	#	#	#	15,193	19,256	61,517		#	18,119		9,495	13,478			
1988		83,382	44,342	2,224	#		16,283	24,614	105,021		#	15,678		#	21,455	#		#
1989		86,748	34,843	7,144	#	#	28,455	73,652	81,427		#	15,300		#	23,749	#		#
1990	#	103,502	10,180	#	#	#	13,769	37,595	63,823		#	26,990		17,526	21,223			#
1991		50,563	10,417	#	#		11,931	15,118	25,312		#	4,700		6,913	15,100	#	#	#
1992		20,491	12,078	#			17,611	12,114	30,788		#	20,374	#	#	15,415		823	4,763
1993		33,511	#	#		#	19,864	20,130	40,655			#	#	#	#		#	
1994	#	21,318	#	#		#	10,217	9,961	22,785		#	#	#		#			#
1995		51,082	#	7,715		#	14,205	5,168	11,640	#	#	3,404		#	#			
1996	#	50,027	1,806	#		#	17,165	18,724	19,313	#	#	9,390		#	17,444			
1997	#	77,556	5,362		#	#	11,512	27,860	48,628	#	12,087	9,293		#	15,958			
1998		70,432	#	#		#	5,714	13,024	13,682		#	5,759			#	#		#
1999		41,076	6,698	#		#	1,611	3,520	5,252			1,360			#			
2000		13,914	#	#	#		2,641	#	#		#				#			

Data not displayed due to confidentiality requirements. Less than 3 vessels fishing.

2.7. Abalone Dive Fishery (Closed) – R. Harbo and L. Convey

2.7.1. Overview

The northern or pinto abalone (*Haliotis kamtschatkana*) has been declining in numbers and distribution in surveyed areas of British Columbia (BC) as documented by regular surveys since the late 1970s. In response to observations of population declines, all BC's northern abalone fisheries were closed to harvest in Pacific fishery waters effective December 15,1990 (Harbo 1994).

In April 1999, B.C.'s northern abalone population was assigned a threatened status by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). This status was reconfirmed by COSEWIC in May 2000.

> COSEWIC Reason for Designation: "A patchily distributed marine mollusc found along the west coast. Highly prized for harvesting, it continues to decline since complete closure of the fishery in 1990, probably as a result of continued high levels of poaching. There is evidence that the decline and fragmentation of the population are impairing the reproductive ability of the species even though there exists a reservoir of reproductive adults."

Further information on northern abalone in BC is available from the DFO abalone web site: http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/Abalone/default.htm

2.7.1.1. Biological Synopsis

Found off the west coast of North America from Yakutat, Alaska (O'Clair and O'Clair 1998) to Turtle Bay, Baja California (McLean 1966), the northern or pinto abalone is one of approximately 65 species of abalone (*Haliotis* spp.) found world-wide (Geiger and Pope 2000). Northern abalone generally occur in patchy distributions in areas of moderate to high sea water exchange on exposed and semi-exposed coasts. Most of the adult northern abalone in BC occur in near shore, exposed or semi-exposed coastal waters at <10 m depth (Sloan and Breen 1988). Separate sexes aggregate in warm shallow water areas to breed by simultaneously broadcasting their gametes (Breen and Adkins 1980).

Within the near shore, exposed or semi-exposed coastal waters, northern abalone play the role of herbivore and are prey of many species. Young northern abalone feed on diatoms and micro-algae. Food for juveniles and adult abalone includes macro-algae and kelp. Recovery of northern abalone may be related to the abundance and health of kelp forests in certain areas. Northern abalone compete with other species (e.g., red sea urchins, *Strongylocentrotus franciscanus*) for food, and interactions with these species should be considered in the recovery strategy. Northern abalone are a prey species for sea otter, *Enhydra lutris*; river otter, *Lutra canadensis*; mink, *Mustela vison*; crab, *Cancer* species; sea stars, *Pycnopodia helianthoides*; octopus, *Octopus doling*; wolf eel, *Anarrhichthys ocellatus cabezon*, *Scorpaenichthys marmoratus*; and other sculpin fish species, Cottidae.

2.7.1.2. History of the Abalone Fisheries in BC

Long harvested by coastal First Nations, abalone (*Haliotis* spp.) meat was consumed as food and the shells or pieces of shell of northern abalone or red abalone traded from California were used in B.C. as fishing lures, in jewellery and as an inlay for carvings (Stewart 1977). Abalone buttons on a ceremonial blanket were a sign of wealth to the Tsimshian (Reece 2000). Harvest was generally restricted to the lowest tides, although some, such as the Haida, also used a three-pronged spear to access abalone in subtidal areas, 2 m below the lowest tide (Jones 2000).

While small recreational and commercial fisheries for northern abalone occurred in BC as early as 1900, a commercial dive fishery directed on northern abalone began in earnest in 1972. Developing through the 1970s, BC's commercial fishery peaked in 1977 with landings of 481 t. The majority of harvest occurred in the north coast of BC and in the Queen Charlotte Islands (Adkins 2000; Campbell 2000b). The value of the commercial fishery peaked at $1.86M (landed value) in 1978 (Sloan and Breen 1988). Northern abalone were also regarded as a gourmet food and recreational divers were known to have had a keen interest in northern abalone harvest.

The life history information and discussions of fisheries management are summarized by Sloan and Breen (1988), Farlinger (1990), and Farlinger and Campbell (1992). An overview of management actions are summarized in Table 2.7.1.

Conservation concerns led to the complete closure of all BC northern abalone fisheries in 1990, including recreational, commercial and First Nations' food, social and ceremonial fisheries. There is no other abalone species occurring within BC with sufficient abundance to directly replace the northern abalone fisheries.

There are currently no commercial fisheries for northern abalone anywhere. There has never been a commercial fishery for northern abalone in Washington State, and Alaska's commercial fishery was closed in 1996. The recreational fishery in Washington also closed in 1994, but there is currently an Alaskan sport fishery. Other species of abalone (e.g., red abalone, H. *rufescens*) from commercial fisheries and aquaculture in other jurisdictions (Australia, Japan, Mexico, China, Taiwan, Europe and the U.S.) are still available in BC.

2.7.1.3. Prospects for the Fisheries

Wild abalone populations in many areas of the world have shown declines. Countries such as Japan, South Africa, New Zealand, Australia and the United States of America, as well as Canada, have documented declines in several abalone species. While many countries have taken steps to limit abalone harvest, populations have continued to decline.

Possible criteria for reopening the northern abalone fisheries in BC were discussed in Campbell (1997). However, recovery of northern abalone in BC is considered a long-term goal and prospects for re-opening of BC's abalone fisheries are not optimistic in the near future. The biology of the northern abalone makes this species particularly vulnerable to over exploitation. The northern abalone is slow growing, relatively long-lived and sedentary, and has low or sporadic recruitment with accumulations of older individuals distributed in shallow water locations easily accessible to harvesters. The high market value, reduced availability, and the difficulty of enforcing the fishery closure since 1990 in a large mostly uninhabited coastal area, has fostered continued illegal harvesting of northern abalone for local consumption as well as commercial sale, hampering attempts to rebuild stocks to a level that would allow a sustainable legal harvest. Samples from abalone illegally harvested during 1995 suggested all sizes of available abalone were removed with no regard for the former minimum size limit of 100 mm shell length that was in force during the legal fishery to allow for a level of reproductive success. Without size and fishing rate controls, egg per recruit analyses suggest that egg production during the period when the fishery was closed could probably be at or less than the level when the fishery was open (Campbell 1997).

2.7.2. Stock Assessment and Research

In BC, the northern abalone population has been assessed since 1977 through surveys of index sites using a standard survey design (Breen and Adkins 1979). Many of the surveys and much of the commercial fishery for northern abalone were conducted in areas along the south-east Queen Charlotte Islands (QCI)) and the central coast of B.C. during 1978-90 (Winther *et al.* 1995; Harbo 1997; Campbell *et al.* 1998). Although there were a few surveys of southern B.C. (Quayle 1971; Breen *et al.* 1978; Adkins 1996; Wallace 1999), they did not afford the extended coverage provided by the northern surveys. Most surveys were conducted in areas with significant commercial harvests, where northern abalone were most abundant (Sloan and Breen 1988).

Surveys at index sites in south east QCI and the central coast of B.C. have provided general time-series trends indicating that the abundance of northern abalone declined more than 75% between the period of 1977-84 and remained low and or continued to decrease through 1998 (Winther *et al.* 1995; Thomas and Campbell 1996; Campbell *et al.* 1998; 2000a). The mean total northern abalone density at comparable index sites changed from 2.4 to 0.2 abalone per m2 for the central coast, during 1979-97, and from 2.8 to 0.5 abalone per m2 for south east QCI during 1977-98. The similarity in northern abalone density between new random sites and index sites indicated that the mean densities from all index sites were reasonably representative of adult northern abalone sampled in areas of the central coast of B.C. in 1997 and south east QCI in 1998 (Campbell *et al.* 1998; 2000a). A transect survey in the central coast of B.C. in 1998 (Lucas *et al.* 1999) confirmed the low densities of northern abalone found by the index surveys in the same area. Surveys and observations in southern B.C. during the 1990s have indicated low densities of northern abalone (A. Campbell and B. Lucas, personal communication). However, Wallace (1999) reported relatively high population abundance of northern abalone in an area close to William Head Penitentiary, near Victoria, where the presence of penitentiary guards may have discouraged poachers from nearshore access.

Breen (1986) and Sloan and Breen (1988) suggested that abalone populations probably fluctuated even in the absence of commercial fishing. Exploratory surveys conducted in south eastern QCI during 1955 by Quayle (1962) suggested that northern abalone were less abundant in 1955 than in both 1914 (Thompson 1914) and in the late 1970s (Sloan and Breen 1988).

Examination of surveyed index sites in both QCI and the central coast indicated a general decline in the number of sites with > 1 northern abalone per m2 between 1978 and 1998 (Campbell 2000b). Index sites with no large abalone (i.e., > 100 mm shell length (SL)) generally increased from zero and 25% to 55% and over 65% for the central coast and QCI, respectively, in the late 1970s to the late 1990s. There were fewer sites during 1997-98 (10-20%) than 1978-79 (45-80%) with densities of > 0.25 large abalone per m2. The decrease in density and decline in the number of sites with northern abalone suggested serial depletion of large abalone during most of the 1990s.

Further research is required to determine the optimal distribution and density of spawners that is required to maintain sufficient recruitment for a healthy northern abalone population, distance of larval transport, and genetic stock discreteness.

2.7.3. Current Management Objectives - Conservation / Sustainability

Following closure of BC's abalone fisheries in 1990, Campbell (1997) recommended that rehabilitation of northern abalone populations should include (1) continued fishery closure until stocks rebuild, (2) reduction of illegal harvest through increased publicity and adoption of new detection and enforcement methodologies (e.g., DNA analysis), and (3) experimental manipulation in well monitored management areas to determine the efficacy of broodstock transplant and juvenile seed restocking methodologies.

In February 1999, an international Workshop on Rebuilding Abalone Populations in British Columbia was held in Nanaimo BC and convened individuals from local communities, First Nations, international research institutes and government organizations to focus on developing solutions to rehabilitate BC's northern abalone population. Thirteen peer-reviewed papers were presented (Campbell 2000a). Workshop proceedings, A Strategy for Rebuilding Abalone Stocks in British Columbia, were prepared for DFO by Dovetail Consulting Inc. (available on the DFO abalone web site). The strategy.

Following the 1999 Workshop, experimental population rebuilding initiatives began in 2000:

1) through Habitat Stewardship Projects with coastal First Nations and coastal communities to aggregate reproductive adults in effort to improve reproductive success and 2) through pilot projects to develop culture techniques to raise juvenile abalone for out-planting experiments.

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Table 2.7.1. Management actions in the B.C. abalone fisheries, 1972 to 1990.

Period of Fishery	Regulatory Controls	Management Actions Taken
Pre - 1972	• open access fishery • size limits	fishery closed during some early years Juan Perez Sound closed (1972) to commercial harvesting to allow for First Nations and recreational harvests
1972-1976	• size limits • category C Licence Vessel • Personal Commercial Fishing Licence	Commercial fishery closed in 1976 after 10.5 months at 273 tonnes due to continued escalation in catch and effort
1978	as in previous years	number of commercial licences reduced to 27 commercial season reduced to 3 months (March through May) additional area closures to allow for First Nations and Recreational harvests some areas closed to low stock abundance
1979	as in previous years validation of commercial landings required prior to off-loading no minimum annual landing requirement (commercial fishery)	number of commercial licences reduced to 26 commercial quota of 227 tonnes commercial fishery divided into a) competitive harvest and b) harvest under equal IQs competitive commercial fishery closed after 18 days commercial IQ fishery open for 7 months additional area closures to allow for First Nations and recreational harvests
1980	as in previous years	commercial quota reduced to 113 tonnes commercial IQ fishery, no open competitive harvests
1981	as in previous years no minimum number of commercial divers	commercial quota reduced to 94.3 tonnes
1983	as in previous years	commercial quota reduced to 70.6 tonnes
1984	as in previous years	commercial quota reduced to 58.0 tonnes
1985	as in previous years individuals could own and operate up to 5 commercial licences	commercial quota reduced to 47.5 tonnes
1986 to 1990	as in previous years	commercial quota remained at 47.5 tonnes
December 1990		commercial, recreational and First Nations food, social and ceremonial fisheries closed

3.0. ECHINODERMS

3.1. Red Sea Urchins (2000/01) – J. Rogers

3.1.1. Introduction

Pacific Scientific Advice Review Committee (PSARC; previously Pacific Stock Assessment Review Committee) Fishery Updates are compiled annually for each commercially harvested invertebrate species. This report will be integrated into a larger summary report on the status of invertebrate stocks in the Pacific Region.

This fishery update and the annual red sea urchin management plan are written as an Integrated Fisheries Management Plan (IFMP), a new format that gives a wider context to the management of the fisheries. The information contained in the fishery update and the IFMP is similar, although additional information on the history of the red sea urchin fishery is available in the fishery update. Fishery updates are available from the Pacific Scientific Advice Review Committee (PSARC) Secretariat ([250] 756-7208), by e-mail at: psarc@pac.dfo-mpo.gc.ca. Stock Status Reports for Red Sea urchins are available at the PSARC website: www.pac.dfo-mpo.gc.ca/sci/psarc/ResDocs/Invertebrate_99.htm. For additional information on red sea urchins, see the reference list in Section 3.1.11.

The Regional Director General for Pacific approves the Integrated Fisheries Management Plan.

3.1.2. Biological Synopsis

The red sea urchin (*Strongylocentrotus franciscanus*) is found from Baja California to Alaska. It is the largest of five species of sea urchins that occurs in British Columbia. Red sea urchins commonly occur on rocky substrates in shallow water areas of moderate to strong currents. Typically, the red sea urchin is found in the intertidal zones to depths of 50 metres, although some individuals occur as deep as 125 metres.

Red urchins have separate sexes and mature at about 50mm test diameter (TD). Reproduction occurs annually with timing of the spawning season varying from March to September depending on local environmental conditions such as food availability and water temperature. Gonads increase in size usually between spawning from September to January. Red sea urchins are broadcast spawners, releasing eggs and sperm into the water column. Fertilization success depends on the local density of adults, the dilution of gametes and local oceanographic conditions. The larvae are planktonic for six to nine weeks prior to settlement on suitable habitat. Juvenile (4mm to 50mm TD) abundance is usually highest when associated with adult red sea urchins as their spine canopy may provide refuge from predators. This juvenile-adult association may be important to the recruitment success of juveniles to the fishery.

3.1.3. Overview of the fishery

The red sea urchin is one of three sea urchin species that have been commercially fished in B.C. waters. Red and green sea urchins are fished under authority of a limited category "Z" licence, category "ZC" for reds and category "ZA" for greens. Purple sea urchins were fished under scientific permit from 1990 to 1992. Fisheries and Oceans Canada is currently reviewing the potential for a purple sea urchin fishery.

Red sea urchins are commercially harvested for their roe (gonad) which is extracted at processing plants for shipment to fresh markets. Red sea urchins are removed from the ocean floor by divers using short aluminium rakes. Packer vessels and trucks deliver the product fresh to plants for processing. The gonad is extracted and processed in B.C., and marketed almost exclusively in Japan, where it is sold as "uni". A smaller market for red sea urchins is developing in other Asian countries and in North America. The yield of roe from a whole animal ranges from five to 15 percent of total body weight.

The dive fishery began in the 1970s and has grown rapidly since 1982. The fishery is considered "data-limited" and while stock assessments are undertaken in many areas, the fishery continues to be managed under a precautionary regime that includes limited entry licensing, area licensing, a minimum size limit, conservative harvest quotas, and an individual quota (IQ) program. There are 110 licence eligibility's for this fishery. Red sea urchin individual licence quotas are set at 1/110 of the annual coastwide commercial TAC and fishers are required to select one of two licence areas in which to fish. These management tools are described in more detail in Section 3.1.3.6.

3.1.3.1. Participants

A personal "ZC" licence is required to participate in the commercial red sea urchin fishery. Licences are limited and currently 110 licences are eligible for participation in the fishery.

The Department negotiates agreements annually with 145 First Nations in BC and the Yukon. Several of these agreements include provisions for the harvest of red sea urchins for food, social and ceremonial purposes. First Nations access to fish for food, social and ceremonial purposes is managed through a Communal Licence.

A British Columbia Tidal Waters Sport Fishing Licence is required for recreational harvest of red sea urchins. The number of sports fishers who participate in the fishery is unknown.

There are generally seven registered processors and buyers involved in the B.C. commercial red sea urchin industry. These facilities are located in Vancouver and Washington State.

3.1.3.2. Location of the fishery

The commercial red sea urchin fishery is licensed over two geographic areas (North and South Coasts of B. C.) and occurs in four geographic locations within those areas: West Coast Vancouver Island (Areas 20 to 27, 121 and 123 to 127), East Coast Vancouver Island (Areas 11 to 19, 28, 29 and 111), North Coast (Areas 3 to 10, 103 to 110) and Queen Charlotte Islands (Areas 1 and 2, 101, 102 and 142). Pacific Fishery Management Area maps can be found on the Internet at: www.pac.dfo-mpo.gc.ca/ops/fm/Areas/areamap.htm.

Aboriginal Communal Licences specify the locations permitted for use by Coastal First Nations for food, social and ceremonial harvests.

Recreational harvest of red sea urchins occurs coastwide. Harvest guidelines are provided in the British Columbia Tidal Waters Sport Fishing Guide.

Experimental fishery and permanent area closures are listed in the commercial harvest plan. These closures restrict commercial fishing activity only and have no impact on the location of First Nations' or recreational harvest.

3.1.3.3. Time frame of the fishery

The commercial fishery is open from July 1 to June 30. Markets generally guide productivity and the majority of the harvesting effort occurs in the winter months.

Fishery timing, through scheduled openings, is critical in order to maintain optimal value for sea urchin roe and to maintain Canada's position in the Japanese market. Commercial harvest schedules are determined in consultation with the Pacific Urchin Harvesters Association (PUHA) and processors. The South Coast fishery takes place primarily during the period of traditional peak market demand, avoiding mid-year months. The North Coast fishery is scheduled to provide a continuous year-round supply of high quality product.

First Nations' and recreational fisheries are open year-round in all areas, or as described in the British Columbia Tidal Waters Sport Fishing Guide for the recreational fishery.

3.1.3.4. Landings, Value and Markets

Appendix 3.1 shows historical landings and value of the commercial red sea urchin fishery. It is anticipated that the recorded value of this fishery will increase as fish slips are finalized for the 2000/2001 fishing season.

The coast-wide commercial TAC for the 2000/2001 season was 4,885.0 tonnes (10,771,533 lb.). IQs were 44.4 tonnes (97,923 lb.). This reduction of 12% of the coast-wide TAC accompanied the reduction in size limit implemented for the 2000/2001 season (see Section 3.1.7.3.). Recorded landings were 4,431.3 tonnes (9,769,351 lb.) for a value of $7.7 M.

The level of First Nations' harvest for food, social and ceremonial purposes and recreational harvest of urchins is unknown at this time. Catch monitoring programs are being developed jointly with some Aboriginal organizations and the recreational fishery organizations.

Commercial Fishery:

Appendix 3.1 shows annual quotas, catch, value and fishing effort. The data has been split to show the difference between fish slip figures and harvest log figures. This data has then been used to present effort by fishing day and by diver hour. All information in this table has been verified and corrected to historical fish slip and harvest log databases. CPUE (t/vessel day) gradually increased from 1986 to 1993, and decreased to a constant level subsequent to the implementation of the IQ program. Effort measured in kg/diver hour also appears to have decreased to a constant level with the IQ program. It is of note that most of the fleet is now directed by buyers, and we believe that the effort data as presented is not a true representation of the effort on the grounds. It may be appropriate to remove this information in future fishery updates.

The overall whole landed value ($/tonne) of red sea urchins remained stable over the period 1989 to 1991, and increased significantly between 1992 and 1994 (Appendix 3.1). Landed value has fluctuated around $1,600 per tonne since 1994.

Appendix 3.2, Figures 1 through 3 are pictorial representations of historical landings and value, and landings by Pacific Fishery Management Area (PFMA) for 2000/2001.

Appendices 3.2 to 3.6 show annual landings by management area and landings by month for the 2000/2001 fishery. The 1971 through 1993 data are from Fisheries and Oceans Canada fish slips. The 1994 through 2000/2001 data are from Validation & Harvest logs, collated by D&D Pacific Fisheries Ltd and the Fisheries and Oceans Canada Shellfish Data Unit.

Total annual landings in B.C. fluctuated between 1993 and 1996. This was due largely to quota reductions in the South Coast, although the commercial industry has also better organized itself to complete those quotas previously unfinished at the start of the new IQ program.

The IQ program approved by Fisheries and Oceans Canada required that individual vessel quotas remain equal. In 1996, the commercial IQ was 132,763 lb. (60.2 t) per licence. South Coast fishers voluntarily elected to divide their IQs into Mainland and East Coast Vancouver Island - Areas 11 to 19, 28 and 29 (89,452 lb.) and West Coast Vancouver Island - Areas 20 to 27 (43,311 lb.). In 1996, the WCVI fishery was poorly attended due to reported poor quality. Flexibility in the plan still only produced a harvest of 58% of the quota in this location. This area was the contributor to an underage of 192.9t in the South Coast in 1996.

Coast-wide landings for the 1996 twelve month commercial fishery were valued at $12.3M for landings of 6,410 tonnes.

The IQ for the eighteen month 1997/98 commercial fishery was 89.6 tonnes (197,439 lb.), comparable to the IQ for the previous twelve month fishery (132,763 lb.). South Coast licence holders split their IQs between East Coast and West Coast Vancouver Island areas. Fishers were permitted to fish up to 48,018 lb. on the East Coast and 149,421 lb. on the West Coast. South Coast licence holders also developed a protocol for quota area openings that gave them a little more flexibility to move throughout the season.

Coast-wide landings during the 1997/98 commercial fishery were approximately 8,738t for the 18 month fishery. The 1997/98 commercial fishery was valued at $14M. In both 1996 and 1997, red sea urchins ranked second in volume and fourth in value of all invertebrate fisheries prosecuted in B.C. waters. Landed value equated to an average of $1.66/kg paid to the fishers. In 1998, the red sea urchin commercial fishery ranked first in volume and fourth in value.

The coast-wide commercial TAC for the 1998/1999 season was 5,601.5 tonnes (12,349,150 lb.). IQs equalled 50.9 tonnes (112,265 lb.). Fishers landed a total of 5,182.9 tonnes (11,426,221 lb.) of red sea urchins, valued at $9.6M or $1.68/kg.

The commercial TAC for the 1999/2000 season was 5,601 tonnes (12,349,150 lb.). Preliminary harvest log and fish slip records show total landings of 5,282.6 tonnes (11,646,019 lb.), for a value of $6.6M. It is anticipated that the recorded value of this fishery will increase as fish slips are finalized for the 1999/2000 fishing season.

3.1.3.5. Consultative process

A consultative process was initiated for the red sea urchin fishery in 1989 and is a major part of the planning for the commercial fishery. The primary consultative body for red sea urchins in B.C. is the Red Sea Urchin Sectoral Committee. This committee includes representatives from Fisheries and Oceans Canada, commercial licence holders, processors, First Nations, B.C. Ministry of Fisheries and the Sport Fishing Advisory Board. Members of PUHA represent commercial fishers on this committee.

The Sectoral Committee's primary mandate is to provide the Department advice with respect to issues important to the management of the commercial red sea urchin fishery, such as developing harvest plans, scheduling research activities, and investigating new management strategies. The Sectoral Committee is not a voting body but allows for the Department to receive a broad range of advice from First Nations, stakeholders and other concerned parties on matters relating to the management of the fishery. The Department remains the decision-making authority regarding management of the fishery. The Sectoral Committee meets annually to review and provide advice regarding the proposed management plan.

Since the move towards more precautionary management in this fishery, commercial fishers and First Nations have collaborated with the Department to undertake research and studies to allow for a better understanding of the resource. The Research Subcommittee of the Sectoral Committee meets annually to review, discuss and advise on stock assessments, recent surveys and future studies proposed for red sea urchins.

The Sectoral and Research meetings are generally held together in the Spring.

Coastal First Nations are notified of the Sectoral and Research meetings by letter and Fishery Notices. Fishery Notices are available through the Internet at: www-ops2.pac.dfo-mpo.gc.ca/fnsreports/rptmain.cfm, in hard copy at Department area offices or through subscription to the regional Operations Centre at (604) 666-0583 (there is a fee for this final service).

The primary consultative body for the recreational fishing community is the Sport Fishing Advisory Board (SFAB). The SFAB has representatives from all parts of the recreational fishing community (i.e. B.C. Wildlife Federation and the Sport Fishing Institute of B.C.).

Following input from the Sectoral Committee, the draft management plan is distributed to First Nations and other stakeholders (i.e. commercial industry representatives) for review and comment at least 30 days prior to the Department's internal finalization process. Stakeholder input to the draft management plan is finalized prior to May 1.

The final management plan, which incorporates advice received from stakeholders, is approved in the Pacific Region and published four weeks prior to the fishery opening. The management plan is made available to the public through the Internet at: www.pac.dfo-mpo.gc.ca/ops/fm/mplans/mplans.htm and in hard copy at Department area offices.

3.1.3.6. Management Styles

Commercial Fishery:

Currently, the main management tools of this fishery include: limited entry licensing, area licensing, a minimum size limit to allow several spawning years prior to harvest, a precautionary fixed exploitation rate of two to three percent of estimated biomass, area quotas and an IQ program in which total quota is divided equally amongst licences.

Scientific research and joint Industry, First Nations, and Fisheries and Oceans Canada stock assessment surveys are of vital importance to the management of this fishery as it moves from a precautionary management regime to a biologically-based fishery. As more information becomes available through surveys and increasing Industry experience, quotas will be modified to better reflect relative abundance and optimum timing for roe quality by area. This process is expected to evolve over a number of years.

Limited Entry Licensing

A limited entry licensing scheme was implemented in October 1991 and 102 licences were issued, a reduction of approximately 46 percent from the previous year. This action was taken to curtail the uncontrolled growth observed in the fishery. By 1994, licence appeals had increased the number of licences to 110, and this level of participation has remained constant to date.

Area Licensing

The number of licences assigned to either the North Coast or the South Coast area is based on biomass estimates for the area. Once a coast-wide TAC is established, commercial licence area TAC's are fine-tuned to ensure equal individual quotas coast-wide. Based on the most recent stock assessment information available, 91 licences are assigned to the North Coast, and 19 to the South Coast.

PUHA provide Fisheries and Oceans Canada with a list of licence area selections. If PUHA is unable to provide the licence area selections, the Department will determine area designation through a process of voluntary placement and lottery out of the over-subscribed area.

Minimum Size Limit

A minimum size limit of 100 mm test diameter has been in effect coast-wide since 1987 to allow the animal several years of spawning before becoming available for the commercial fishery. When the North Coast fishery opened year-round in 1988, both the minimum size limit and a maximum size limit of 140 mm test diameter were instituted for PFM Areas 1 through 10. The maximum size limit was removed in 1993. Note: the landings and value figures presented in this document for the 2000/2001 fishing season are based on a minimum size limit of 100 mm.

PUHA has long requested a reduction in size limit to be able to produce a more competitive product for world markets. PSARC Working Paper I99-23 provided quota options for a reduction in size limit in the red sea urchin fishery. Following recent consultation with the red sea urchin Sectoral Committee, the Department implemented a reduced size limit for this fishery. Commencing July 1, 2000, the minimum size limit for commercially harvested red sea urchins was reduced to 90 mm or 3.5 inches. To compensate for this and to maintain the precautionary approach to this fishery, a 12% reduction in TAC accompanied the reduction in size limit. This reduction in TAC was based on an egg-per-recruit analysis which suggested that the egg-per-recruit at 90 mm test diameter is 12% lower than that of urchins at 100 mm test diameter. Red urchins mature at approximately 60 mm test diameter. The 90 mm size restriction will still meet conservation goals of allowing several years of spawning prior to becoming available for commercial harvest.

There is no size limit for the First Nations' or recreational red sea urchin fishery.

Precautionary Fixed Exploitation Rate

A modified surplus production model is used to estimate maximum sustainable yield (MSY). Total current biomass of red urchins is calculated biannually, based on new survey results and changes to commercial bed area estimated from digitized harvest log charts. A natural mortality rate of 0.10 is assumed, and a correction factor of 0.20 provides for a conservative harvest rate of approximately 2% (Campbell *et al.* 1999).

Area Quotas

In conjunction with area licensing, the coast-wide commercial TAC is divided into area quotas. Quota Areas are comprised of Pacific Fishery Management Areas, Subareas, or a combination of portions of Subareas. The TAC for each Quota

Area is calculated from the density estimates and range of quotas provided by the Department's Stock Assessment Unit. Where surveys and density estimates are not complete for an area, they are extrapolated from a nearby survey.

Opening schedules are set in consultation with Industry. In the South Coast, Quota Area opening dates are determined in-season; three vessels must "hail-in" to the service bureau prior to an area being opened.

The North Coast fishing fleet may include as many as 40 boats at any one time. It is often difficult to schedule area openings that best suit both the size of the fleet and the current market demand for product. For the 1999/2000 season, the Department and PUHA implemented a harvest protocol that required each Quota Area to be fished to completion once opened. Weather conditions and roe quality were considered in-season, and moves were permitted if either issue dramatically hampered the fishery. This protocol was used again in the 2000/2001 season.

Individual Quota Program

Following several years in a management regime that the commercial industry perceived to be causing processing and market gluts, poor quality landings and unsafe diving conditions, PUHA voluntarily implemented an IQ program in 1994 and 1995. The coast-wide TAC was divided equally among licences and a third party service bureau was hired to monitor catch. In late 1995, the Minister of Fisheries and Oceans Canada sanctioned a pilot IQ management regime for the red sea urchin, green sea urchin and sea cucumber fisheries. Individual quotas were formally implemented for the 1996 red sea urchin fishery. Changes from the previously voluntary IQ system were minor and dealt with such things as quota transfer, area licensing and licence stacking.

Catch validation at the first point of landing is required and an Industry-funded monitoring and validation program was developed collaboratively between PUHA, Fisheries and Oceans Canada and D&D Pacific Fisheries Ltd. Licence conditions ensure that all fishers participate in the pilot IQ program, which continues to date. Overall, the IQ program has resulted in a more orderly, safer fishery and has afforded the industry more flexibility in opening times and locations.

PUHA funds a charter patrolman (On-Grounds Monitor, OGM) to attend the remote North Coast fishery for eight months a year. The OGMs duties include: providing a communication link between the North Coast Fishery Manager, the service bureau and the red sea urchin fishing fleet; monitoring fishing effort; checking dive harvest information; observing product transfer to packers; and providing summaries of fishing activity and fishing ground observations, i.e. location, bed dimensions, product quality, harvester comments.

History of Commercial Management Styles

Appendix 3.7 outlines historical management actions for the red sea urchin fishery. The red sea urchin dive fishery began in the 1970's and has grown rapidly since 1982. The fishery is considered "data-limited" and while stock assessments are undertaken in many areas, the fishery continues to be managed under a precautionary regime.

Red sea urchin landings were first reported from 1971 to 1977. All harvesting was carried out in South Coast management areas, and participation was very low. Minor landings in the North Coast were first reported in 1986.

In 1987, harvest quotas were set for many South Coast areas and weekly openings were built around the market demand. The North Coast fishery was conducted under an experimental management regime with rotating fishing areas through 1993. No quotas were set.

Fishing notification and catch reporting were required coastwide in 1989. Harvest log sheets and books came mandatory in 1990 and 1991, respectively.

Fisheries and Oceans Canada implemented a limited entry licensing scheme in October 1991 and 102 licences were issued, a reduction of approximately 46% from the previous year (Appendix 1). This action was taken to curtail the uncontrolled growth observed in the fishery. By 1994, licence appeals had increased the number of licenses to 110 and this level of participation has remained constant through to the 2000/01 fishery.

The North Coast fishery was restricted in 1993 following concern for exponential increases in annual catch that peaked at approximately 12,480t in 1992. In 1993, a TAC of 5,443t was allocated for the North Coast and managed by timed area openings. The fishing schedule was modified a number of times in-season to accommodate Industry's need for a consistent market supply and high quality roe. In some areas, fisheries were terminated when large fleets harvested excessive quantities of urchin. High effort in the early months of the fishery (4,536t were harvested by May) resulted in a fishing suspension for the summer months. 907t of the TAC were retained for the fall fishery.

The management scheme employed in the North Coast in 1993 proved cumbersome and did not give fishery managers sufficient control of the fishery. Licence area selection and area quotas based on historic catch levels were imposed in 1994. The total North Coast quota remained at 5,443t, with a further 454t available as exploratory quota.

In 1994, PUHA received consensus from its membership to implement a voluntary individual quota system. Since this was self-imposed, Fisheries and Oceans Canada approval was not required. Nonetheless, Fisheries and Oceans Canada facilitated the process by altering the fishing plan to accommodate PUHA. The program provided improved monitoring of catch and effort and resulted in a more orderly fishery, allowing the industry more flexibility in opening times and locations. Fishers requested that the coast be divided into a northern and southern area, separated at Cape Caution. This stabilized effort in each area and reduced the amount of vessel running time between openings. Fishers were required to select either the North Coast area or the South Coast area, and each licence was allocated an equal proportion of the coastwide quota.

From the onset of the IQ system, historical concerns with quota overages were replaced with new problems of quota underages. At the end of the 1994 season, approximately 816 t of product were left in the water. This was the result of growing pains in the IQ system, and was made more significant by the slow harvest of geoduck IQs – some fishers abandoned their red sea urchin IQs late in the season in order to complete their more valuable geoduck quotas. The significant underages were not repeated during the 1995 or 1996 seasons. A company hired by the fishers validated all landings. Fishers were required to notify the validation company prior to fishing and upon leaving an area. Quotas were not often exceeded as all landings were validated and weights were taken at the dock. Fishers generally began to fish for quality rather than quantity and, over time, the industry has learned to reduce both quota overages and underages. Fishers and processors were just beginning to work together to ensure product was available to processors at times appropriate for the market.

As a result of the IQ program, speculation on the value of the fishery increased licence value and landed value of the product through 1994 and 1995. Value peaked and stabilized by the end of 1996.

The commercial fishery in the North followed a predetermined schedule of openings. This schedule was developed through consultation with fishers and processors and was based on stock assessment advice. Once a schedule was drafted and accepted, it was published in the annual management plan. No scheduled fishing dates were moved forward, but if a monthly quota had been achieved prior to the end of that month, fishers could harvest quota that was scheduled but not taken in previous months.

South Coast fishery managers scheduled openings for the spring and late fall. This schedule remained flexible and actual fishing dates were determined in season, through consultation with the fishers and processors, to ensure that activity was conducted during periods of strong market demand.

In late 1995, the Minister of Fisheries and Oceans Canada sanctioned the IQ management regime for red sea urchin, green sea urchin and sea cucumber fisheries. Sanctioning the process allowed Fisheries and Oceans Canada to impose license conditions ensuring that all fishers participated in the quota management program. As a condition of the offer of a quota fishery to the commercial industry, the Minister required that 2% of the TAC be held in abeyance for Aboriginal food, social and ceremonial purposes.

The Fisheries and Oceans Canada pilot IQ program was implemented for the 1996 red sea urchin fishery. Changes from the previously voluntary IQ system were minor and dealt with things like reduced flexibility in quota transfer between vessels in season. A vessel could hold a combination of North and South Coast licences, to a maximum of 3 licences per vessel. A monthly schedule of openings was set for the North Coast in 1996. PUHA hired a charter patrolman to attend the fishery for 8 months a year. Catch validation at first point of landing was required and an Industry funded monitoring and validation program was developed collaboratively between PUHA, Fisheries and Oceans Canada and D&D Pacific Fisheries Ltd.

In 1997, an 18 month fishery was scheduled to facilitate a change from a calendar to a biological year. In future, the fishery will run from July 1 to June 30. As a result of new stock assessment advice, the South Coast quota was reduced and the North Coast quota increased by the equivalent of two IQs. 91 IQs were assigned to the North and 19 IQs to the South. The North Coast harvest schedule was refined to permit area changes every 2 weeks in some months. The Stock Assessment Division harvest log and the service bureau validation log were amalgamated into one document. Chart records of fishing areas were also required.

For the 1998/99 fishing season, PUHA implemented a North Coast Fishing Protocol that worked through a block system of quota areas. The original fishing protocol was designed to open a large portion of the coast and have the On-Grounds Monitor (OGM) guide the fleet through the Block, one Fishing Area at a time. Varying opinions and interpretations of the fishing protocol often resulted in tension on the grounds. When several Quota Areas were legally open, vessels spread out over the entire open area, rather than work together with the OGM to move through the areas in an orderly manner. It became increasingly difficult for the OGM to track vessel activity and landings. To alleviate this problem, Fisheries Management closed all but one or two adjacent Quota Areas. Requests to move were received as soon as 20% of the Quota Area was completed, and this resulted in a request from the Regulations Unit to institute a 48 hour minimum requirement for change to Variation Order (used to open and close fishing areas). Variation Orders must be signed by the Regional Director General, hence the 2 day leeway needed to ensure that either the RDG or a replacement is available for signature.

Aboriginal Fishery:

The Department seeks to provide for the effective management and regulation of the Aboriginal fishery through negotiation of mutually acceptable and time-limited Agreements which outline provisions pertaining to the fisheries and co-management activities. The agreements include provisions by which First Nations manage their members' food, social and ceremonial fisheries in addition to outlining First Nation involvement in a range of co-management activities and economic development opportunities which may include, but not be limited to, habitat enhancement, catch monitoring and enforcement, fish management and community research. The First Nations' harvest of shellfish for food, social and ceremonial purposes is regulated through the Aboriginal Communal Fishing Licences Regulations made under the Fisheries Act. Communal licences are issued annually to First Nations under the authority of these regulations and include a mechanism for designating individuals and vessels to fish under the authority of that licence, outline the harvest area, any harvest or gear limitations, as well as the harvest reporting requirements. Communal licences can be amended in-season for resource conservation purposes. Even where an agreement cannot be concluded, Fisheries and Oceans Canada issues communal fishing licences to First Nations organizations.

It is the policy of the Department to encourage increased Aboriginal communal participation in and integration with coastal commercial fisheries. Aboriginal involvement in the fishery is a shared goal between the Department and Aboriginal people. It is a means to stimulate Aboriginal economic development opportunities and develop fisheries expertise in Aboriginal communities, while serving as the basis for more co-operation between Aboriginal communities and the commercial fishery sectors. Aboriginal participation in the commercial fisheries is being accommodated through the Licence Retirement/Allocation Transfer Program. The Fisheries and Oceans Canada Licence Retirement/Transfer Program (ATP) retires existing commercial licence eligibilities from fishers on a voluntary basis and re-issues these to eligible Aboriginal organizations as communal commercial licences.

For additional information on Communal Licences, see the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/afs/commlic.htm. For more information on the Aboriginal Fisheries Strategy (AFS) Licence Retirement/Allocation Transfer Program, see the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/afs/retire.htm.

Recreational Fishery:

The recreational harvest of shellfish is regulated through the *British Columbia Sport Fishing Regulations* made under the *Fisheries Act*. The regulations are summarized annually in the British Columbia Tidal Waters Sport Fishing Guide, which lists closed times and areas, bag limits and size limits (where applicable). If necessary, public notices are posted to document closures or changes from the Guide. Closures may be implemented in order to conserve vulnerable stocks, to protect the public from consumption of contaminated shellfish or to meet Aboriginal food, social and ceremonial needs. For some species, areas have been closed to commercial harvest or commercial harvest openings have been delayed to provide an opportunity for the recreational community. The daily maximum sport limit for all sea urchins combined is 12, with a possession limit of 24.

3.1.3.7. Links with Other Planning Initiatives

Oceans Management Strategy

Integrated Management (IM) of all activities related to estuarine, coastal and marine waters is a key long-term objective of the Department's Oceans Management Strategy for Canada. The Department is committed to ensuring wide consultation and collaboration in development and implementation of the Strategy. For further information visit their website at www.pac.dfo-mpo.gc.ca/oceans.

Integrated management and integrated fisheries management planning, share common objectives of adopting a precautionary approach, addressing ecosystem considerations, engaging a broad mix of interested stakeholders in management processes and facilitating sustainable development. In the future, IM planning processes will address the linkages between associated species management plans in a given geographical area, identify broad local interests, identify potential sites, objectives and management requirements for Marine Protected Areas (MPAs), and identify opportunities for ongoing monitoring of marine health.

In June 1999, four pilot MPAs were proposed for Pacific Region: Endeavour Ridge Hydrothermal Vents, Bowie Seamount, Race Rocks and Gabriola Passage. The impact of these proposed MPAs on red sea urchins is unknown at present. A collaborative process will provide full opportunity for consultation with all interested parties as MPA development proceeds.

The provincial Land Use Co-ordination Office (LUCO) and Fisheries and Oceans Canada have agreed to work collaboratively on a unified process to address the coastal near-shore area of the Central Coast of BC. Currently, Fisheries and Oceans is participating in the provincially led Central Coast Land and Coastal Resource Management Plan initiative (through Oceans Act Implementation). The products of the CCLCRMP include the identification of issues, values, general management objectives; strategic-level zones and sub-zones (including protected areas); specific management prescriptions and guidance for activities within each of the zones. It is anticipated that, subsequent to this process, Fisheries and Oceans Canada will initiate an Integrated Management process as part of Oceans Act Implementation. An Integrated Management process would be broad in scope, including all groups with an interest in the marine area.

The West Coast Vancouver Island Aquatic Management Board, a locally based management body, has been proposed for the West Coast of Vancouver Island. The Department is committed to negotiating a pilot Board before the end of 2000. This pilot provides a forum for the coastal communities and other persons and bodies affected by aquatic resource management to participate more fully with governments in all aspects of the integrated management of aquatic resources in the management area. Ample opportunity for advice from interested stakeholders will be provided as this initiative proceeds.

British Columbia Ecological Reserves

In respect of B.C. Ecological Reserves, the Department applies permanent fishing closures in those reserves with a marine component that may be impacted by this fishery.

Parks Canada

Harvesting is closed permanently in the Pacific Rim National Park and Broken Group Islands.

Gwaii Haanas National Park Reserve and proposed Marine Conservation Area encompasses the archipelago in southern Queen Charlotte Islands south of a boundary extending from Tasu Sound on the west and Tangil Peninsula on the east. On-grounds catch sampling is undertaken in the waters adjacent to the Gwaii Haanas National Park. Parks Canada and the Council of the Haida Nation jointly manage the park. Contact the Parks Canada - Gwaii Haanas National Park Reserve (P.O. Box 37, Queen Charlotte B.C. V0T 1S0; or visit the Internet at www.harbour.com/parkscan/gwaii/) for information.

Selective Fishing

For the purposes of fisheries management in the Pacific Region, selective fisheries are defined by Fisheries and Oceans Canada as the ability to avoid known non-target species and stocks or, if encountered, to release them alive and unharmed.

In May 1999, the Department released a paper entitled Selective Fishing in Canada's Pacific Fisheries – A New Direction (Anon 1999). The paper outlines the objectives and strategies that form the basis of ensuring all fisheries in the Pacific Region become selective. With consideration of the comments and feedback received on this paper, the policy is being finalized for release in spring 2000. The paper and related information can be found on the Internet at: www-comm.pac.dfo-mpo.gc.ca/english/selective/.

The Canadian Code of Conduct for Responsible Fishing Operations

Canada played a leading role in the development of the UN Food and Agriculture Organization's (FAO) Code of Conduct for Responsible Fisheries. In 1994, the Canadian commercial fishing industry moved to create a Canadian code that would build on the international code, meet the unique needs of Canadian commercial fishers, and be built by the industry for the industry.

The Canadian Code of Conduct for Responsible Fishing Operations, designed by commercial harvesters, for commercial harvesters, provides operational standards and practical directions to aid in attaining responsible and sustainable harvesting operations for all commercial fishing operations in Canadian waters. The code encompasses 10 Conservative Principles, the foundations for conservation, and 36 Operational Guidelines, the ways to achieve conservation.

The Canadian Responsible Fisheries Board, made up of commercial harvesters, is responsible for overseeing ratification of the Code by commercial fishing organizations in Canada, and will work with the Department in implementing the Code through fishing, conservation and enforcement plans. The Board members were chosen by Canadian commercial fishers and represent the Atlantic and Pacific coasts, the Arctic and freshwater fisheries, and Aboriginal commercial fish harvesters.

In the Pacific Region, the following organizations have ratified the code as of December 1999: Deep Sea Trawlers Association of B.C., Area D Gillnet Association, Area E Gillnetters Association, Fishing Vessel Owners' Association of British Columbia, Pacific Gillnet Association, Pacific Trollers Association, Northern Trollers Association, B.C. Beam Trawlers Association, Underwater Harvesters Association, Pacific Urchin Harvesters Association, Pacific Halibut Management Association of British Columbia, Gulf Trollers Association, and Krill Trawlers Association.

The Code, and related information, can be accessed on the Internet at: www.responsiblefisheries.com or from:

Secretariat, Canadian Code of Conduct for Responsible Fishing Operations
200 Kent Street, Station 13093
Ottawa, Ontario K1A 0E6
Tel: (613) 990-0157
Fax: (613) 990-9691
Email: secretariat@responsiblefisheries.com

Treaty Negotiations

Aboriginal access to fisheries and integration into the management of the fishery resource are important components of most land claims and self government negotiations. Fisheries and Oceans Canada participates in these negotiations as part of the Federal team to achieve settlements which meet conservation requirements, satisfy Aboriginal aspirations regarding fisheries, and take into account the needs of third parties. Within Fisheries and Oceans Canada, Pacific Region, the Treaty and Aboriginal Policy Directorate represents the Department in Treaty negotiations with First Nations in both B.C. and the Yukon.

The lead Federal agency in B.C. Treaty negotiations is the Federal Treaty Negotiations Office (FTNO) of Indian and Northern Affairs Canada (Internet link: www.inac.gc.ca/). The other participants in these tripartite negotiations are the provincial government and First Nations. Treaty negotiations in B.C. are facilitated by the B.C. Treaty Commission (Internet link: www.bctreaty.net/). Yukon treaty negotiations have occurred under a separate Yukon Treaty process.

3.1.3.8. Aquaculture and Enhancement

The Department recognizes the aquaculture industry as a legitimate user of Canada's aquatic resources and will provide access to brood stock and seed stock for industry development purposes (growth and diversification), by scientific licence, on an as-needed basis, subject to conservation requirements. Requests to access the wild red sea urchin resource for development purposes must be supported by detailed project proposals, approved by the Department.

3.1.3.9. Policy

Proposed Pacific Region Interim Operating Guidelines Regarding Access to Shellfish for Aboriginal Harvesting

Fisheries and Oceans Canada is developing these guidelines in order to help the Department evaluate future requests submitted by Aboriginal people for management changes in commercial and recreational shellfish fisheries for the purposes of securing access to shellfish resources for food, social and ceremonial purposes. These principles and proposed procedural guidelines will apply only to shellfish species in tidal waters.

Draft Pacific Region Policy on the Culture of Marine Invertebrates

A policy on the culture and enhancement of marine invertebrates in the Pacific Region is being developed and reviewed. Consultation will continue with the commercial industry, First Nations and other stakeholders.

3.1.4. Stock Status

3.1.4.1. Biology, environment, habitat and species interactions

See the document entitled Stock Status Report (contact the Science Branch or see the Internet at www.pac.dfo-mpo.gc.ca/sci/psarc/SSRs/ssrs.htm).

3.1.4.2. Assessment

Fisheries and Oceans Canada, PUHA and First Nations joint stock assessment activities continue coastwide through biomass transect surveys, experimental harvest sites and selected study sites. PUHA established a research fund in 1995 and co-ordinates vessel and diver participation in surveys with First Nations communities. Fisheries and Oceans Canada develops the survey protocol and conducts the data analysis. The main survey goals are to prove and/or adjust quotas accordingly, and to better understand the growth and recruitment potential of red sea urchins.

See the following PSARC research documents for additional information:

> Discussion paper on a precautionary approach for management of the red sea urchin fishery in British Columbia. Can. Stock Assessment Secretariat Res. Doc. 99/094.
>
> Quota options for the red sea urchin fishery in British Columbia for fishing season 2000/2001. Can. Stock Assessment Secretariat Res. Doc. 99/201.
>
> These are available from the PSARC Secretariat (250 756-7208) by e-mail at: psarc@pac.dfo-mpo.gc.ca or on the Internet at: www.pac.dfo-mpo.gc.ca/sci/psarc/ResDocs/res_docs.htm.

3.1.4.3. Research

Scientific research and joint commercial industry, First Nations, and Fisheries and Oceans Canada stock assessment surveys are of vital importance to this fishery as it moves from a precautionary management regime to a biologically based fishery.

PUHA continues to support and participate in growth and mortality studies. Biomass information from co-operative surveys in the North Coast and bed areas provided by commercial fishers are being examined and presented in PSARC working papers.

Research areas were established in the early 1990s in Clayoquot Sound (red sea urchin Quota Area 24D, south east coast of Vargas Island), near Plumper Island (Area 12), Cumshewa Inlet (Subarea 2-3) and West Price Island (Subarea 7-31). These research areas have been established in co-operation with PUHA, the Haida Fisheries Program and the Kitasoo Fisheries Program, and have been removed from the commercial fishery for at least 10 years. Ongoing programs include: population surveys; experimental harvests using several size limits to assess the effect on recruitment patterns; long-term red sea urchin population trends; and, growth rate estimation through chemical tagging.

A pilot survey of red sea urchin size frequencies, and gonad yield and quality will be conducted at processing plants throughout the 2000/2001 fishing season. The fishery-related data will be useful in estimating future precautionary quotas in a fishery that changed the size limit from 100 mm to 90 mm test diameter for the 2000/2001 commercial fishery.

Biomass survey procedures will be re-evaluated to accommodate the finer scale assessment (i.e., from broad areas to Pacific Fishery Management Subareas and beds) required by fishery managers.

3.1.4.4. Prospects for the fishery

The red sea urchin fishery is managed conservatively, and apart from a few areas which have been closed or quotas reduced because populations have declined, stocks generally appear healthy. A precautionary approach to management, which ensures the Department is meeting its conservation goals, will continue for the foreseeable future. This, in turn, will ensure sustainable harvests by all user groups. The long term goal of the Department is to develop a biologically-based management regime through a better understanding of the resource. This will be accomplished through a collaborative process involving the commercial industry, Aboriginal organizations and other stakeholders.

Sea otter populations are expanding in B.C. and may become major predators on red sea urchin populations in the future. Currently the department is not considering sea otters in the management of the red sea urchin fishery.

3.1.5. Management Issues

3.1.5.1. Ongoing:

- Long term strategy for collection of basic biological information, assessment techniques and management regimes required. **Action: PSARC working paper I99-15, June 1999.**

- Need basic biological information (i.e. age, growth, recruitment and migration) in support of the management of this species. **Action: Continue collaborative research with PUHA, First Nations and other interested stakeholders.**

- Need to better understand the influence of varying exploitation rates on the resilience of local populations. **Action: Maintain a time series of data on un-fished, moderately fished and potentially over-fished populations and experimental areas. Research sites in Cumshewa Inlet (Subarea 2-3) and West Price Island (Subarea 7-31).**

- Need to increase monitoring of the commercially harvested populations, both through surveys and port monitoring in order to provide appropriate focus for assessment papers. **Action: Processing plant-based monitoring of size frequency of commercial catch started in 2000/2001 fishing season.**

- Need to quantify commercial fishery-induced mortalities (e.g. loss through testing of quality prior to harvest, breakage during sorting on deck, dumping of undersize product, breakage during transport). **Action: Work in progress.**

- Need to address and evaluate the impacts of commercial red sea urchin fisheries on the ability of First Nations to harvest for food, social and ceremonial purposes. **Action: Work in progress.**

- Commercial industry feels that the 100 mm minimum size limit is too restrictive as the 90 to 100 mm size category is the most desirable to the market. Action: PSARC working paper I99-23, December 1999; pilot reduction in size limit for the 2000/2001 fishing season. **Action: PSARC working paper I99-23, December 1999; pilot reduction in size limit for the 2000/2001 fishing season.**

- Individual quota program does not fully address: distribution of fishing effort, quality-oriented harvest, continuous market supply, and maintaining competitive access to the Japanese market. **Action: Make annual improvements to the IQ program. Reassess Quota Area boundaries every year, and make changes where necessary to redistribute effort.**

- New initiatives in the commercial fishery require flexibility in the development of the annual management plan. **Action: Annual consultation with the commercial industry and stakeholders to build an appropriate management plan.**

3.1.5.2. Historical:

- Population data supporting a North Coast quota is required. **Action: Ongoing density and stock assessment surveys**.

- Continued interest by the commercial industry to conduct research in the North Coast in anticipation of increasing the TAC. **Action: Ongoing density and stock assessment surveys.**

- Make improvements to the IQ Program to address: distribution of fishing effort; quality-oriented harvest; continuous market supply; and, maintaining competitive access to the Japanese market. **Action: Reassess Quota Area boundaries on an annual basis, and make changes where necessary to redistribute effort. 1998/99 Block system.**

3.1.6. Specific Management Objectives

3.1.6.1. Conservation/Sustainability

- A more comprehensive understanding of the biology of red sea urchins and the impacts of commercial harvest on red sea urchin populations is required in order to ensure conservation and sustainable harvests in this fishery. The goal of the Research Subcommittee of the Sectoral committee (consisting of PUHA, First Nations organizations and the Department) is to undertake biological investigations. These include biomass estimates through transect surveys in various locations of the B.C. coast, and experimental harvest and study areas where populations are manipulated to examine urchin growth, migration and recruitment.

- A method to accurately determine age has yet to be discovered, although recent work by Thomas Ebert of San Diego State University shows that some red sea urchins may attain ages as much as 100 years.

- Given that we know little about the age of these animals, the Research Subcommittee will consider prioritizing the assessment of spatial and seasonal juvenile growth, survival and recruitment. This information could assist managers in determining the appropriate level of fishing pressure by time and area. Appropriate techniques for the assessment of juvenile recruitment are imperative for fisheries, such as sea urchins, where recruitment is inconsistent throughout the fishing areas. An area devoid of juvenile red sea urchins could indicate that the area is vulnerable to over-fishing.

3.1.6.2. International Considerations and Obligations

Information to Transport, Import and Land Shellfish in Canada

Pursuant to the *Coastal Fisheries Protection Act*, foreign fishing vessels can only enter Canadian waters and offload fish where a licence is issued under *the Coastal Fisheries Protection Regulations,* or a treaty authorizes such activities. In the case of U.S. vessels, there is a treaty in place for roe herring, salmon, tuna, halibut and sablefish. However, only vessels from flag states listed in section 5(1)(a) of the *Coastal Fisheries Protection Regulations* are eligible to be issued licences to land fish in Canada. As the U.S. is not on this list, U.S. vessels are not eligible to receive licences to land other species (including shellfish) in Canadian ports.

Masters of Canadian fishing vessels receiving shellfish, i.e. transhipping shellfish, from a U.S. fishing vessel, in waters other than Canadian fisheries waters, require four licences. Contact the Pacific Fishery Licensing Unit in Vancouver (Tel: [604] 666-0566, Fax: [604] 666-5855) for further information.

3.1.6.3. Domestic Considerations

Commercial Fishery:

The Department will continue to work collaboratively with Industry, Aboriginal organizations and other stakeholders to ensure conservation and sustainability of this resource. Management of the red sea urchin resource will progress from a precautionary regime to one based on biological information, through assessment and application of data collected from harvest logs, population surveys and research areas.

Aboriginal Fishery:

Fisheries and Oceans Canada recognizes the importance of fish to the Aboriginal people of British Columbia. The Department will continue to provide First Nations with access to harvest fish for food, social and ceremonial purposes, in a manner consistent with the Sparrow decision (see the Internet at: www.pac.dfo-mpo.gc.ca/ops/fm/AFS/Default.htm for more information).

Under the pilot IQ program, two percent of the estimated coastwide TAC is reserved for First Nations food, social and ceremonial purposes. Additional allocation for red sea urchins will be considered for First Nations who demonstrate they are unable to meet the food, social and ceremonial needs of their members.

The Aboriginal Fisheries Strategy seeks to provide for the effective management and regulation of the Aboriginal fishery through negotiation of mutually acceptable and time-limited Fisheries Agreements. Even where an agreement cannot be concluded, Fisheries and Oceans Canada issues communal fishing licences to First Nations organizations allowing them to fish for food, social and ceremonial purposes.

Recreational Fishery:

The Department will continue to strive toward providing opportunities for a recreational fishery for red sea urchins.

Exploratory/Experimental Fishery

See Section 3.1.4.3 Research.

3.1.7. Management Measures

3.1.7.1. Fishing Season

The commercial fishery takes place from July 1 to June 30, subject to scheduled openings and in-season closures.

First Nations' and recreational fisheries are open year-round in all areas, or as detailed in the British Columbia Tidal Waters Sport Fishing Guide for the recreational fishery.

3.1.7.2. Control and Monitoring of Fishing Activities

Commercial Fishery:

Currently, the main management tools of the red sea urchin fishery include: limited entry licensing, area licensing, a minimum size limit to allow several spawning years prior to harvest, a precautionary fixed exploitation rate of two to three percent of estimated biomass, area quotas and an IQ program in which total quota is divided equally amongst licences.

Catch Validation Agreement

A collaborative agreement between the Department and PUHA to provide for in-season catch validation is consistent with the Department's approach to co-management in the Region. This agreement provides catch validation at designated landing ports, in-season collection and compilation of harvest log data, collection of biological samples, on-grounds monitoring of the North Coast fishery, and a year-end summary report of the fishery. The catch validation program is industry-funded. PUHA funds this, and research programs, through fees to Association members. The Department provides in-kind support.

Fishing Notification and Dockside Validation

Fishers are required to report harvest time and location information to a service bureau prior to fishing, following fishing, and prior to landing red sea urchins. In order to track daily harvests and ensure that area quotas are not exceeded, all catch must be weighed and validated at the first point of landing by a Fisheries and Oceans Canada certified observer.

Licence Area Selection

The coast is divided into two harvest areas, one of which each licence is designated to prior to the fishing season. Harvest area designation is accomplished through voluntary area selection and, when required, a lottery conducted by Fisheries and Oceans Canada. The PUHA is responsible for ensuring that the area selection process is completed prior to the fishery opening.

Aboriginal Fishery:

The Department's policy on the Management of Aboriginal Fishing identifies First Nations' harvests for food, social and ceremonial purposes as the first priority after conservation. This fishery is regulated through the issuance of communal licences to First Nations and/or Aboriginal Organizations. These licences are issued under the authority of the Aboriginal Communal Fishing Licence Regulations. Further arrangements for Aboriginal fishing may be identified in agreements between the Department and individual First Nations or Aboriginal organizations.

Communal licences and Fisheries Agreements may contain provisions for the designation of individuals by the First Nation or Aboriginal organization to access the allocation provided under the communal licence, as well as provisions for monitoring and reporting by the group of the Aboriginal fishery in co-operation with the Department.

Recreational Fishery:

The recreational harvest of shellfish is regulated via the *British Columbia Sport Fishing Regulations, 1996* made under the *Fisheries Act*. The regulations are summarized annually in the **British Columbia Tidal Waters Sport Fishing Guide** which lists closed times, bag limits, size limits (where applicable) and closed areas. If necessary, public notices are posted to document closures or changes from the Guide. Closures may be implemented in order to conserve vulnerable stocks, or to protect the public from consumption of contaminated shellfish or to meet Aboriginal food, social and ceremonial needs. For some species, areas have been closed to commercial harvest or commercial harvest openings have been delayed to provide a recreational opportunity.

3.1.7.3. Quota Allocations

The following table shows the most recent stock assessment figures used to calculate the commercial TAC for 2000/2001. See the document entitled Quota Options for the Red Sea Urchin Fishery in British Columbia for Fishing Season 2000/2001 (Can. Stock Assessment Secretariat Res. Doc. 99/201) for more detail. Surveys and assessments are incomplete for some areas of the coast, so assessed figures may be lower than the proposed commercial quota for some PFMAs. The Department and PUHA are committed to continuing joint stock assessment surveys in order to fill these data gaps. The proposed commercial quota is considered precautionary under the range of natural mortality rates (M=0.052 to M=0.15) presented in the working paper.

Under the pilot IQ program initiated in 1996, two percent of the coastwide TAC is reserved for First Nations' use for food, social and ceremonial purposes. This two percent is removed from the coastwide TAC prior to calculating the commercial TAC.

The coastwide commercial TAC for 2000/2001 was 4,885.9 tonnes (10,771,533 lb.); 4,042.0 tonnes (8,911,000 lb.) assigned to the North Coast and 843.9 tonnes (1,860,533 lb.) to the South Coast. Individual quotas equalled 1/110 of the commercial TAC, or 44.4 tonnes (97,923 lb.). In the South Coast, a maximum of 65,074 lb. of the IQ may be harvested from Areas 11 to 19, 28 and 29, and a maximum of 32,849 lb. of the IQ may be harvested from Areas 20 to 27, 111, 121 and 123 to 127.

History of commercial quota allocations

Initial area quotas were largely arbitrary and precautionary. Since 1995, however, the quotas for many areas have been based on survey information and catch data from mandatory harvest logs.

Historically, area quotas on the South Coast were set at 5% of the surveyed biomass. This was then extrapolated to include areas where surveys were not conducted. As the fishery area expanded, quotas were based on estimates of standing stock determined through consultation with fishers.

Prior to the implementation of the IQ program, days fishing per week were limited to 2 or 4 days in the January and February fisheries in Areas 12 and 13. After IQ implementation (starting with summer fisheries in 1994), an area was left open until the quota was achieved. This was made possible through the use of the validation company

Table 3.1.1. Coastwide total allowable catch (tonnes) presented over a range of natural mortality rates (M) for red sea urchins 90-130 mm in test diameter.

	Coastwide total allowable catch (tonnes) over a range of natural mortality rates (M)		
	M=0.075	**M=0.10**	**M=0.15**
North Coast Areas 1 to 10	3,734.5	4,979.4	7,469.1
2 percent of TAC for First Nations use	74.7	99.6	149.4
Available for commercial fishery	3,659.8	4,879.8	7,319.7
Commercial TAC 2000/2001		4,042.0	
South Coast Areas 11 to 29	604.4	805.9	1,208.8
2 percent of TAC for First Nations use	12.1	16.1	24.2
Available for commercial fishery	592.3	789.8	1,184.6
Commercial TAC 2000/2001		843.9	
Coastwide	4,338.9	5,785.3	8,677.9
2 percent of TAC for First Nations use	86.8	115.7	173.6
Available for commercial fishery	4,252.1	5,669.6	8,504.3
Commercial TAC 2000/2001		4,885.9	

landing, daily catch and fishing activity records. The duration of North Coast openings was determined in consultation with Industry.

In 1997, an eighteen month management plan was developed to permit a licensing change from a calendar year to a market-driven year from July through June. The TAC for the 1997/98 management plan was 9,854 tonnes, of which 8,152 tonnes were assigned to North Coast areas and 1,702 tonnes to South Coast areas. This was comparable to the 1996 TAC of 6,625 tonnes for a twelve month fishery.

Scheduling fisheries and defining quota areas has become increasingly complex. In 1996, there were 23 South Coast quota areas (a group of Areas, Subareas or portions of Subareas where boundaries define an area to which a quota is attributed) fished in 18 openings. In the North Coast, 33 quota areas were fished during 36 different openings. In 1997/98, 23 South Coast quota areas were fishing during 69 openings, and 45 North Coast quota areas were fished during 106 openings. In 1998/99, the South Coast was divided into 24 quota areas and the North Coast was divided into 54 quota areas.

The coastwide commercial TAC for the 1998/99 management plan was reduced by approximately 12% from that of the 1997/98 management plan. This was the result of new information with respect to the biology of red sea urchins, survey results from new areas, improved estimates of harvest areas from harvest logs, and additional information provided by fishers (see PSARC Working Paper I98-10 Quota Estimates for the 1998 Red Sea Urchin Fishery in British Columbia).

The coastwide commercial TAC for 1998/99 was 5,601.6 tonnes (12,349,150 lb.). The commercial TAC for North Coast areas was 4,634.0 tonnes (10,216,115 lb.)

and for South Coast areas was 967.5 tonnes (2,133,035 lb.). Individual quotas equalled 1/110 of the commercial TAC, or 50.9 tonnes (112,265 lb.). In the South Coast, a maximum of 84,147 lb. of the 112,265 lb. could be harvested from Areas 11 to 19, 28, 29 and 111, and a maximum of 28,118 lb. of the 112,265 lb. could be harvested from Areas 20 to 27, 121 and 123 to 127.

3.1.7.4. Licensing

Commercial:

Prior to 1992, red sea urchins were fished under the authority of a C licence, a general purpose licence issued under Schedule II of the Pacific Fishery Regulations.

Licence limitation was introduced in the red sea urchin fishery in October 1991 when 102 licences were issued. This was a reduction of approximately 46% from the number of licences issued in the previous fishing year. This action was taken to curtail an uncontrolled growth that had been observed in the fishery. By 1994, licence appeals had increased the number of licences to 110, and this level of participation has remained constant through to the 2000/2001 fishery.

Red sea urchins are harvested commercially under the authority of a commercial licence (ZC) or a communal commercial licence (FZC). All licences are held by an individual party who must designate a harvest vessel each year. A maximum of three licences may be designated to any one vessel. The designated vessel must be eligible for a commercial vessel-based licence of any of the following categories: A, C, F, G, K, L, N, R, S, T and W.

Commercial ("ZC") licences are "transferable" in that a licence holder may nominate a new party as the holder of the licence eligibility. Communal commercial ("FZC") licences are allocated annually to First Nations groups, who may designate the licence to a vessel which meets the same criteria as the general commercial fishery licences.

Commercial red sea urchin licence fees for the 2000/2001 season were $530.

Vessel length restrictions for vessels used to harvest red sea urchins under the IQ pilot have been waived by Fisheries and Oceans Canada such that "ZC" licences may be designated to a vessel of any length permitted to harvest Schedule II species. Fisheries and Oceans Canada reserves the right to reinstate vessel length restrictions at the lengths associated with each licence tab.

Aboriginal:

First Nations access to fish for food, social and ceremonial purposes are managed through a Communal Licence. Catch monitoring and reporting requirements are outlined in the fisheries agreement and/or Communal Licence. Communal Licences can be amended in-season for resource conservation purposes. For additional information on Communal Licences, see Section 3.1.3.6 Management Styles and the Internet at: www.pac.dfo-mpo.gc.ca/ops/fm/afs/commlic.htm.

Recreational:

A B.C. Tidal Waters Sport Fishing Licence is required for the recreational harvest of all species of fish. The daily limit for the recreational harvest of **all sea urchins** combined is 12, with a possession limit of 24.

Processing

"P" licences are issued under the *Pacific Fishery (General) Regulations*, and must comply with the Fish Inspection Regulations. As a result, effective June 1998, any processing beyond that permitted in Section 14 (FIR) must be done in a registered fish processing facility and in full compliance with a Quality Management Program (QMP). If product processed at sea is to be eligible for export (leaving B.C.), the vessel must be a registered fish processing facility, i.e. registered with the Canadian Food Inspection Agency (CFIA) and have an approved QMP. If the processed product is intended for sale within B.C., the vessel must meet B.C. Ministry of Fisheries and B.C. Health requirements, prior to the issuance of a "P" licence.

Key Legislation

The *Fisheries Act* and the regulations made thereunder.

Areas and Subareas, as described in the *Pacific Fishery Management Area Regulations*, are referenced in describing Quota Areas.

Fishery (General) Regulations (i.e. Conditions of Licence) and the *Pacific Fishery Regulations, 1993* (i.e. open times and size limits).

The British Columbia Sport Fishing Regulations (1996) and the Aboriginal Communal Fishing Licences Regulations.

3.1.7.5. Conservation Harvesting Techniques and Selective Fishing Requirements

The commercial harvest of red sea urchins meets the Pacific Region's requirements for avoiding "known non-target species and stocks or, if encountered, to release them alive and unharmed." Since commercial divers are restricted to hand picking, suction devices are not permitted, and a minimum size limit has been implemented, there is no bycatch in this fishery.

3.1.8. Enforcement Measures

3.1.8.1. Overview

The enforcement policy and responsibilities of the Department are directed by the Conservation and Protection (C&P) directorate within the Fisheries Management sector. Enforcement activities are carried out by fishery officers, marine enforcement officers, fishery guardians, and Aboriginal fishery guardians working throughout Pacific Region. Observers, designated by the Department, complement enforcement staff by performing a monitoring, verification and sampling function.

There are approximately 170 fishery officers stationed in the Pacific Region, which encompasses the province of British Columbia and Yukon Territory. They are designated as "fishery officers" under section 5 of the *Fisheries Act* and have full enforcement powers and responsibilities outlined in the Act, *The Criminal Code of Canada*, and the *Constitution Act*. The fishery officer's uniform is khaki and green.

Marine enforcement officers also carry "fishery officer" designation and have the same powers and responsibilities as fishery officers. They work from Canadian Coast Guard vessels and are trained in enforcement duties. The marine enforcement officer's uniform is blue and black.

The "fishery guardian" designation is held by charter patrolmen. Fishery guardians have more limited enforcement powers than a fishery officer does. Primarily they carry out observe, record and report activities and they have the authority to inspect, lay charges, and make seizures. They do not have the powers of search or arrest. The charter patrolmen's uniform consists of a blue shirt and grey slacks, and a blue hat with the charter patrol crest.

Aboriginal fishery guardians are employed by their Band or Tribal Group and wear the uniform of that Band or Tribal Group. They are tasked with enforcement of the Aboriginal fishery of their Band or Tribal Group. Aboriginal fishery guardians may assist fishery officers in enforcement activities outside the Aboriginal fishery, depending on their level of training and the agreement between the Band and the Department.

Observers, designated by the Department, perform duties related to monitoring of fishing activities, examination and measurement of fishing gear, recording scientific data, monitoring the landing of fish and verification of the weight and species of fish caught and retained, and biological sampling. Observers are not armed and do not have the powers of search, seizure, or arrest.

In general, compliance in the red sea urchin commercial fishery is good due to dockside validation, mandatory harvest and validation logs and at-sea monitoring in the North Coast.

However, considerable fishery officer effort has been dedicated to ensuring compliance with the four inch size limit. It is believed that a red sea urchin measuring 3.5 inches provides better, high quality yield. This may encourage the harvest of undersize animals. Fishery managers and C&P officers will be assessing the implications of a reduced size limit during the 2000/2001 fishing season.

An additional complication arises when measuring urchins, as the animals are not completely symmetrical.

Enforcement staff will pursue opportunities to enforce the regulations applicable to these fisheries while engaged in enforcement activities directed to priority fisheries in the Pacific Region.

Managers and shellfish biologists have provided C&P fishery officers with impact statements to use in court cases and they have been most useful in increasing the resultant fines.

The Departmental Violation System and the Fishery Officer Reporting System will provide better measures of patrol effort and compliance rates.

Results from Previous Season (North Coast Only)

C&P Prince Rupert spent 41-program vessel hours and 77 hours at processing plants. Officers boarded 12 vessels and checked 25 fishers, resulting in 12 charges and one vessel seized. There were three warnings and one ticket issued for licence conditions infractions.

3.1.8.2. Main Program Activities

Priorities for 2000/2001

The priorities for this season are to work with fishery managers on the grounds, to monitor the harvest during the new size limit fishery, and to support complaints received from dockside monitors.

In-season

Fishery officers and marine enforcement officers will conduct monitoring and compliance patrols at-sea using program vessels (RIBs) and Coast Guard vessels. Boarding will be conducted to ensure compliance to both vessel and individual licence requirements. Checks will be made to ensure non-retention of prohibited species and compliance with size restrictions. Both open and closed area patrols will be conducted.

Transportation vehicles will be checked en route from off-loading sites to processors. Fishery officers will also conduct checks at processing facilities.

Fishery officers will conduct dockside monitoring checks for size limit, container tags and prompt completion of Validation & Harvest Logs as per the Conditions of Licence (*Fisheries [General] Regulations* Section 22).

Fishery officers will respond in support of the On-Grounds Monitor (OGM), the Dockside Validators and any at-sea observers that may be used. Fishery officers will also co-ordinate patrols with First Nations Guardians and fishery managers when the opportunity presents itself.

3.1.8.3. Fishery Patrol Vessels

All at sea patrols will be conducted using program vessels (mostly 7.3 meter and 9.2 meter rigid hull inflatable vessels) and CCG vessels. They are staffed and operated by fishery officers, native guardians, and marine enforcement officers. At-sea patrols will be conducted on a planned and ad hoc priority basis. Coast Guard Patrol vessels as well as C&P program vessels, in conjunction with Fishery Officers and Marine Enforcement Officers, will conduct boardings in the harvest areas.

Patrols will be conducted in both open and closed areas as priorities allow.

3.1.8.4. Air Surveillance

Patrol coverage using charter aircraft is utilized to identify concentrations of fish and fishers as well as distribution. In large geographical areas this allows for a better utilization of C&P resources. Air surveillance resources are utilized generally July to September and longer if available.

Flight reports, photographs, and other data collected from overflights are readily available to departmental managers and fishery officers through an intranet-based flight information system. Digital images of vessels will be collected and added to a web-based licence system, providing fishery officers ready access to recent vessel photographs to assist in field identification.

3.1.8.5. Enforcement Issues and Strategies

In the following table:

PFR: *Pacific Fisheries Regulations, 1993*
F[G]R: *Fisheries (General) Regulations*
S: Section

ISSUE	SECTION	STRATEGY
Licensing Verification • vessel licensed • experimental licence • no FRC • fail to produce FRC	PFR S 22 F[G]R S 52 F(G)R S 68(1) PFR S 25 F(G)R S 11	At-sea and dockside inspections will occur when opportunities exist. These inspections may include checks of all licensing documents on board the vessel to ensure compliance with the Regulations.

ISSUE	SECTION	STRATEGY
Fish during closed time/area.	PFR S 63	Patrols utilizing patrol vessels will be pursued when opportunities exist. Possibilities may exist to use the Regional Enforcement Charter Aircraft in co-ordination with other patrols scheduled for Priority fisheries.
Size Limit	PFR S 70(1)	At sea and dockside inspections will be pursued when opportunities exist.
Fail to maintain "Validation & Harvest Logbook".	F(G)R S 22(7)	At sea and dockside inspections will occur when opportunities exist. Investigations may also occur on an opportunistic basis after C&P have been notified by fisheries management that a violation has occurred. The investigation will be pursued when larger priorities permit.
Landings validated at time of offloading.	F(G)R S 22(7)	Dockside inspections and monitoring will be pursued when opportunities exist.
Fail to carry on-board observer when requested by Fisheries and Oceans Canada.	F(G)R S 22(7)	At sea and dockside inspections will occur when opportunities exist.

3.1.9. Financial Responsibilities

3.1.9.1. Commercial Industry and/or other Harvesters

PUHA was established in 1993, and since that time has contributed significant advice toward management and research program development. Annual harvest schedules are developed in consultation with both fishers and processors.

A collaborative agreement between the Department and PUHA describes catch monitoring and biological sampling programs. PUHA funds management and research programs through fees to association members. Industry funding provides for a catch validation program, stock assessment surveys, biological research surveys and a biologist hired to co-ordinate research activities with the Department. PUHA also hires a charter patrolman for eight months a year to monitor and guide the harvest in the North Coast. Association fees for the 2000/2001 fishing season were $5,321.36 per licence.

Several coastal First Nations contribute time and expertise through collaborative research surveys with PUHA and the Department by way of biologists, vessels and divers.

3.1.9.2. Fisheries and Oceans Canada

One Stock Assessment and three Resource Management personnel are directly involved in this fishery. Contributions to the IFMP are provided by the Fisheries Management Directorate, the Science Branch, the Shellfish Data Unit, the Conservation and Protection Directorate, the Pacific Fishery Licence Unit, the Aboriginal Fisheries Strategy, the Recreational Fisheries Division, the Oceans Directorate and numerous administrative personnel. Generally, all personnel are multi-tasked, i.e. Fishery

Managers work on all dive fisheries. Therefore, costs incurred by the Department to manage this fishery are difficult to assess.

3.1.10. Performance Review

3.1.10.1. Annual (post season) Review Results

Overall, the 2000/2001 fishing season was successful. 110 licences were fished on 52 vessels. Although weather and poor roe quality hampered harvesting in some areas, the total allowable catch was closer to being achieved than in any other year. No major issues were documented and in general, compliance with the catch validation program was good. Comments on the reduced minimum size limit were generally positive.

A review of 2000/2001 Management Plan Evaluation Criteria follows:

- Continue with biological research, density surveys and experimental studies.
- Surveys in 2000 included Laredo Channel, Areas 6-14 and 6-15 (July 2000), Tofino, Areas 24-2, 24-6, 24-8 and 124-3 (September 2000), and the Deserters Group, Area 12-13 (November 2000).
- Assess availability of resource for First Nations food, social and ceremonial purposes. Maintain lines of communication and continue consultation.
- Collaborative studies have been initiated with the Haida Fisheries Program. Data is unavailable at this time.
- Assess redesign of Quota Areas in the north coast. Did the reassignment of areas succeed in redistributing effort?
- Several quota areas were split into smaller areas for the 2000 season. This had the desired effect of distributing effort throughout the quota areas. More splits are contemplated for the 2001 fishing season.
- Assess value of Quota Area maps. Were they useful to fishers? Did accuracy of data improve?
- Quota Area maps appear to be useful for divers, though there is a need for maps to be a larger scale. There is still some confusion around Pacific Fishery Management Area boundaries and Quota Area boundaries. The Department and D&D Pacific Fisheries continue to educate the fleet on these matters.

3.1.11. References Cited

Campbell, A., Bureau, D. and Brouwer, D. 1998. Pacific Stock Assessment Review Committee Working Paper I98-10: Quota Estimates for the 1998 Red Sea Urchin Fishery in British Columbia.

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Campbell, A., Hajas, W. and Bureau, D. 1999. Quota options for the red sea urchin fishery in British Columbia for fishing season 2000/2001. Can. Stock Assess. Secret. Res. Doc. 99/201.

Rogers, J. and Parker, G. 1999. Pacific Stock Assessment Review Committee Fishery Update.

Appendix 3.1. Annual red sea urchin landings (tonnes), value and effort for British Columbia, 1978 to June 2001, as reported on fish slips and harvest logs.

					FISH SLIP DATA					HARVEST LOG DATA		
Year	Licences Issued	Vessels with Landings	South Coast Quota[1] (t)	North Coast Quota (t)	Coastwide Landings (t)	Landed Value ($000)	Total Vessel Fishing Days	Whole Landed Value ($/t)	X CPUE (t/vessel day)	Coastwide Landings (t)	Total Diver Hours	X CPUE (kg/diver hr)[3]
1978	C	4			75.0	16.0	54	213	1.4	-	-	-
1979	C	29			317.0	76.0	298	240	1.1	-	-	-
1980	C	18			333.0	84.0	331	252	1.0	-	-	-
1981	C	18	136		116.0	34.0	127	293	0.9	-	-	-
1982	C	21			160.0	56.0	195	350	0.8	45.4	75.6	-
1983	Z 64	36			982.0	357.8	757	364	1.3	720.2	1,428.4	504
1984	Z 85	47			1,764.4	712.2	1,058	404	1.7	1,377.0	3,781.6	364
1985	Z 86	46	1,803		1,815.4	763.5	1,126	421	1.6	1.204.4	2,881.6	418
1986	Z 103	67	1,500		2,066.6	1,010.8	1,534	489	1.3	1.582.0	3.397.0	466
1987	Z 184	97	1,633		2,223.4	1,275.6	1,737	574	1.3	1,435.6	3,429.4	419
1988	Z 184	84	1,678		2,115.4	1,238.2	1,239	585	1.7	1,763.8	5,056.7	349
1989	Z 240	98	1,644		2,658.1	1,631.5	1,542	614	1.7	2,004.8	5,409.4	371
1990	Z 188	88	1,668		3,158.1	1,953.0	2,651	618	1.2	2,439.7	7,478.7	326
1991	Z 102	76	1,531		6,945.2	4,187.1	3,862	603	1.8	6,427.4	16,356.0	393
1992	Z 108	102	1,554		12,981.8	8,661.5	6,222	667	2.1	12,479.9	31,170.0	400
1993	Z 107	95	1,401	5,443	6,388.0	5,372.7	3,364	841	1.9	6,106.4	17,201.5	355
1994	Z 110	95	1,543	5,897	5,828.7	8,066.4	3,978	1,384	1.5	5,959.8	18,942.0	315
1995	Z 108	88	1,387	5,455	6,584.7	11,349.8	4,167	1,724	1.6	6,806.9	21,397.7	318
1996	Z 109	77	1,265	5,360	5,282.5	10,045.8	3,536	1,902	1.5	6,466.4	18,180.3	356
1997/98 [2]	Z 110	90	1,702	8,150	8,450.8	14,000.9	5,161	1,601	1.6	8,738.2	30,227.4	289
1998/99	Z 110	68	968	4,635	5,076.7	7,865.1	3,239	1,336	1.6	5,182.9	16,554.4	313
1999/00	Z 110	61	968	4,635	4,896.1	7,832.1	3,027	1,600	1.6	5,282.6	16,664.8	317
2000/01	Z 110	53	844	4,042	4,431.3	7,739.1	2,704	1,746	1.6	4,815.3	14,041.0	343

[1] South coast quota includes exploratory areas; North Coast quota new in 1993.

[2] Change in licencing from calender year to market-driven year. 1997/98 season ran January 1/97 to June 30/98.
Licencing year continued to be July to June

[3] CPUE from harvest log data.

Appendix 3.2. Annual red sea urchin landings (tonnes), value and effort for British Columbia, 1978 to June 2001, as reported on fish slips and harvest logs.

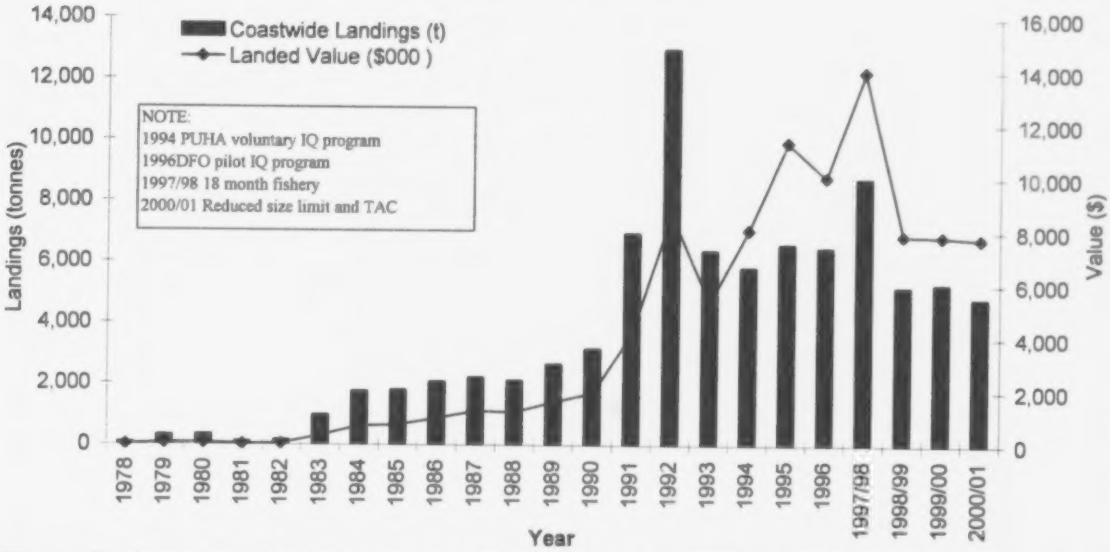

Figure 1. Commercial red sea urchin landings and value, 1978 to 1998; 1978 to 1993 as reported on fish slips and 1993 to 2001reported as on harvest logs.

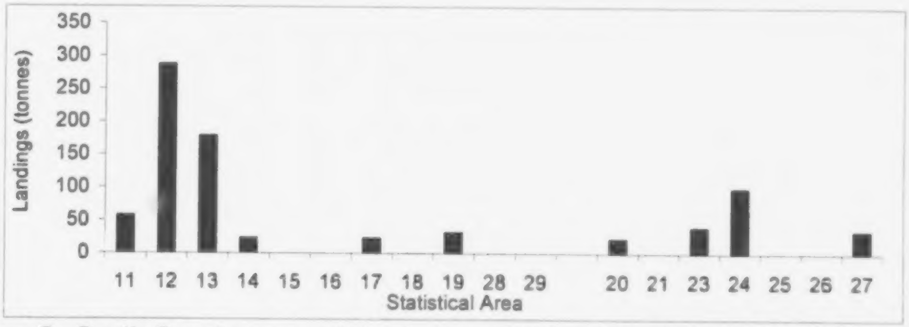

Figure 2. South Coast commercial red sea urchin landings (tonnes) by statistical area for 2000 to 2001.

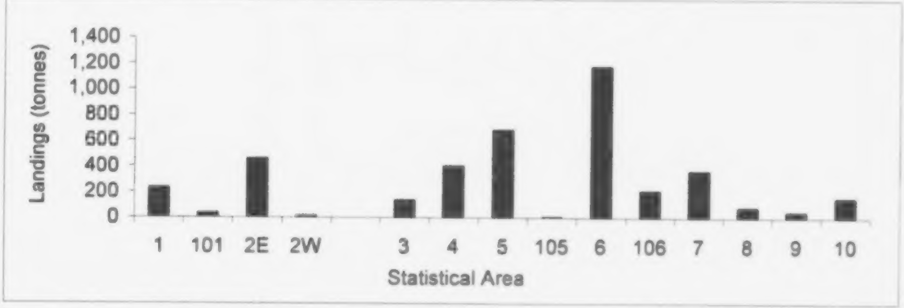

Figure 3. North Coast commercial red sea urchin landings (tonnes) by statistical area for 2000 to 2001.

Appendix 3.3. Summary of red sea urchin landings (tonnes) by North Coast Management Area 1984 to June 2001, as reported on fish slips and Validation & Harvest logs.

NORTH COAST MANAGEMENT AREAS

	QCI				NC Mainland										Annual Landings
Year	1	101	2E	2W	3	4	5	105	6	106	7	8	9	10	
1984	2.2														2.2
1986														12.0	12.0
1987						23.0					179.0	91.0			293.0
1988						73.0	11.0		7.3		314.0	32.0			437.3
1989	0.2		223.0		1.6	116.0	1.3		168.0		217.0	65.0		180.0	972.1
1990			26.6	10.7	24.5	156.8	265.3		67.1		1,040.1				1,591.1
1991			333.1	2.7	143.3	1,026.7	2,577.3		77.7		774.7	114.6	24.5	304.9	5,379.5
1992			1,111.0		1.0		3,294.0		4,063.0		2,763.0	140.0	114.0	38.0	11,524.0
1993	97.0		189.0	88.9	127.2	1,008.0	463.0		2,103.0		1,012.0	43.4		215.3	5,346.8
1994	221.5		402.2	167.4	173.0	687.0	1,041.8	13.9	933.9	310.6	861.0	57.0	46.0	164.0	5,079.3
1995	258.0		440.2	256.3	48.5	940.3	1,280.1		932.6	120.3	1,076.0	111.0	49.2	224.1	5,736.6
1996	259.0		365.0	241.8	65.7	856.2	1,165.9	7.1	1,089.0	129.8	860.5	122.1	10.4	248.0	5,420.5
1997/98	549.4	32.9	719.7	310.0	62.0	1,074.8	1,103.9	*	1,939.8	235.2	870.1	111.6	40.6	152.5	7,202.5
1998/99	240.0	36.2	294.0	144.1	39.7	594.2	734.7	*	1,227.7	144.7	526.2	87.6	34.8	193.4	4,297.3
1999/00	284.5	11.6	288.9	222.3	32.4	602.6	737.0	*	1,283.9	146.4	462.6	88.1	38.6	189.5	4,388.4
2000/01	233.5	36.0	458.2	12.8	136.8	400.8	682.7	7.7	1,175.5	210.0	361.9	78.3	44.2	155.2	3,993.6
1984 to June 1999	1,911.8	80.7	4,392.7	1,444.2	718.9	7,158.6	12,675.3	21.0	13,893.0	1,087.0	10,956.2	1,063.4	358.1	1,921.7	57,682.6

* Data not provided for reasons of confidentiality where less than 3 vessels report landings.

Appendix 3.4. Summary of red sea urchin landings (tonnes) by South Coast Management Area 1971 to June 2000, as reported on fish slips and Validation & Harvest logs.

SOUTH COAST MANAGEMENT AREAS

	East Coast Vancouver Island											West Coast Vancouver Island							Annual Landings
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	
1971 to 1973[1]									110.0						254.0				364.0
1974 to 1977[1]		1.4		**	**	1.4			66.0			**		1.3					70.1
1978			**						46.0			29.0							75.0
1979			**	78.0			57.0	133.0	45.0			1.8	0.9	2.5					318.2
1980				18.0			162.0	54.0	97.0			1.8							332.8
1981			20.0	4.0	**		5.3	47.0	22.0						17.0				115.3
1982		2.5		46.0			0.8	11.0	94.0						5.0				158.5
1983[2]	7.8	99.0	264.0	260.0	**	**	59.0	38.0	112.0			24.0		22.0	38.0		62.0		985.8
1984	0.3	437.0	777.3	172.0			33.0	67.4	76.3		5.7	69.1		17.3	103.0		3.9		1,762.3
1985		354.0	492.0	167.0	106.0	5.9	29.0	48.0	77.0		47.0	30.0		96.0	158.0	145.0	15.0	45.0	1,814.9
1986	27.0	548.0	376.0	178.0	56.0	4.4	57.0	129.0	105.0		2.0	40.0		154.0	285.0		2.5	91.0	2,054.9
1987[3]	6.9	420.0	491.0	193.0	32.4		71.0	71.0	123.0	17.0	7.8	17.0		63.0	199.0	95.0	8.3	12.0	1,827.4
1988	2.6	534.0	480.0	78.0	21.0	2.3	**	22.0	78.0			74.0		13.0	250.0	66.0		58.0	1,678.9
1989		569.0	493.0	122.0	6.7		9.0	64.0	57.0		1.6	15.0			223.0	39.0		86.0	1,685.3
1990	84.8	437.6	428.4	56.6	1.2	0.6	43.0	46.5	58.6	0.3	1.8	7.9		59.7	215.1	56.8		68.1	1,567.0
1991	36.4	358.7	370.7		6.6		26.6	94.8	27.2		14.1	31.2	2.7	58.4	185.1	115.8		121.1	1,451.4
1992	8.0	531.0	320.0				103.0	36.0	88.0		4.0	56.0	9.0	31.0	200.0	10.0		65.0	1,459.0
1993	55.5	329.0	184.0				21.0	104.7	17.3			14.5		40.4	92.0	7.0	2.0	50.0	917.4
1994	17.3	348.3	167.9				4.2	59.4	13.7		1.1	2.6		53.5	111.4	49.7		49.4	878.7
1995	34.0	364.5	174.7				28.0	69.2	14.9		8.8	20.5		57.0	198.7			98.5	1,068.8
1996	37.8	344.2	236.5				24.8	111.9	6.7		10.5	33.2		46.1	122.4			70.1	1,046.2
1997/98	61.2	593.7	425.7				25.6	66.5	40.2		15.7	32.4		53.8	132.0			84.8	1,531.5
1998/99	52.4	282.3	196.4				26.9	87.9	18.5		2.9	*		31.5	107.6			48.4	877.3
1999/00	81.1	270.4	204.3				26.6	63.0	42.7		*	22.6		29.1	113.1			27.3	884.4
2000/01	57.3	287.3	178.7	23.0			22.7	*	32.1		*	22.0		39.3	99.1			34.6	821.7
1971 to June 1999	513.1	6,824.6	6,103.9	1,372.6	231.9	14.6	812.0	1,424.3	1,434.1	17.3	123.0	522.8	12.6	829.6	3,009.3	584.3	93.7	974.7	24,925.1

* Data not provided for reasons of confidentiality where less than 3 vessels report landings.

** Less than 500 kg.

[1] Data for each year cannot be published separately.

[2] Mandatory log book under Z licence came into effect in 1983.

[3] Sales slips were combined for red and green sea urchins in 1987, were later separated by price criteria, but 320 t remains missing in area table.

Appendix 3.5. Summary of landings (tonnes) by North Coast Management Areas as reported on Validation & Harvest logs.

NORTH COAST MANAGEMENT AREAS

	QCI				NC Mainland										
Month	1	101	2	142	3	4	5	105	6	106	7	8	9	10	Monthly Totals
Jul-00															
Aug-00													17.0	20.0	37.0
Sep-00							80.2		47.8	90.5				9.7	228.1
Oct-00					16.2	252.4	292.0	*							*
Nov-00					34.5	90.7	267.9		365.1						758.2
Dec-00									579.8	77.0	220.4				877.2
Jan-01									131.0	10.6	77.4	75.7	27.1	82.6	404.6
Feb-01			311.7		86.1	57.6	23.5								478.9
Mar-01	233.5	36.0	39.9												309.4
Apr-01			106.7	12.8			19.1	*	51.9	31.9	51.1			37.9	*
May-01											13.0	*		*	20.6
Jun-01															
Grand Total	233.5	36.0	458.2		136.8	400.8	682.7	7.7	1,175.5	210.0	361.9	*	44.2	155.2	3,993.6

* Data not provided for reasons of confidentiality where less than 3 vessels report landings.

Appendix 3.6. Summary of landings (tonnes) by South Coast Management Areas in 1999/00 as reported on Validation & Harvest logs.

SOUTH COAST MANAGEMENT AREAS

	East Coast V.I.									West Coast V.I.						
Month	11	111	12	13	14	17	18	19	29	20	23	123	24	124	27	Monthly Totals
Jul-00																
Aug-00																
Sep-00											33.0	*	97.2	*		138.4
Oct-00			*	72.6	23.0	11.9									12.5	142.1
Nov-00			106.3			*			*						*	127.0
Dec-00		*	72.5	106.1			*	32.1		22.0						259.1
Jan-01	20.4		43.3			*										64.6
Feb-01	*	*	*													11.5
Mar-01		14.2	29.5													43.7
Apr-01	2.8	*	*													14.2
May-01	*		*												*	21.0
Jun-01																
Grand Total	32.3	25.0	287.3	178.7	23.0	22.7	*	32.1	*	22.0	33.0	*	97.2	*	34.6	821.7

* Data not provided for reasons of confidentiality where less than 3 vessels report landings.

Appendix 3.7. History of Management Actions in the red sea urchin fishery, 1971 to date.

Year	Comments			Closures	Licensing			Size limit	Total Allowable Catch(TAC) & Individual Quota(IQ)				
	General	North Coast	South Coast		General comments	Licence	# licences		Coastwide TAC	IQ	North Coast TAC	South Coast TAC	Quota overage permitted
1971 to 1977	First reported landings. Participation very low.		All landings in South Coast.			C (prior to 1982)							
1982 to 1985	Steady increase in effort and landings.					Schedule II plus ZC	64 (1983), 85 (1984), 88 (1985)					1, 803 tonnes (1985)	
1986	Steady increase in effort and landings.	Minor landings in North Coast.				Z	103					1,500 tonnes	
1987	Harvest logs and fish slips required.	Fishery open year-round, no quotas. Fishery focused in Central Coast due to proximity to South Coast plants.	Quotas set for many areas, based on 1981 and 1984 surveys. Harvesting period reduced to highest market demand (October 15 to February 15, Sunday through Thursday).	Voluntary compliance closures for First Nations use.		Z	184	min.100mm				1,833 tonnes	
1988	Harvest logs and fish slips required.	Experimental management. Fishery open year-round.	South Coast areas open 4 d/week (Sunday through Wednesday), with the exception of WCVI, open 7 d/week from September 11 to October 15.	SA 2-13 closed to set boundaries for rotational areas.		Z	184	min.100mm (max.140mm in NC)				1,833 tonnes (plus exploratory)	
1989	Fishing notification and catch reporting required.	Experimental management continues. Rotational fisheries.	South Coast openings Sunday through Wednesday at varying periods throughout the year.			Z	2240	min.100mm (max.140mm in NC)				1,844 tonnes	
1990	Fishing notification and catch reporting required. 1990 Harvest Logbooks.	North Coast fishery open year-round. Area restrictions and rotational fishery.	South Coast quotas mostly arbitrary. Area quotas set to limit expansion until stock and biological information is collected and evaluated. Fishery limited to traditional peak market demand, October to February. Openings 4 to 7 d/week at periods throughout the year.			Z	188	min.100mm (max.140mm in NC)				1,888 tonnes	
1991	Fishing notification and catch reporting required. 1991 Harvest Logbooks.	North Coast effort and landings increased significantly. Research requested in support of lowering the size limit. Rotational fishery January 7 to December 31.	South Coast openings varied throughout year.		Licence limitation (October 21/91).	Z	102	min.100mm (max.140mm in NC)				1,531 tonnes	
1992	Notification, catch reporting and fishing data requirements.	Rotational areas.	South Coast openings built around markets. Most openings for 4 d/week. Additional exploratory areas implemented for WCVI.	North Coast closures considered for First Nation allocation. New closures in Areas 14, 15, 16.		Z	108	min.100mm (max.140mm in NC)				1,554 tonnes	
1993	Landings monitored at first point of landing. PUHA steering committee established. Maximum size limit removed.	Reductions in NC quota anticipated. Rotational areas. Three fishing periods: January to May, June to August, October to December.	Quota lowered due to overages in 1992. Area, opening and quota changes. All openings Monday through Thursday.			Z	107	min.100mm			5,443 tonnes	1,401 tonnes	

Appendix 3.7. continued

Year	Comments			Closures	Licensing			Size limit	Total Allowable Catch(TAC) & Individual Quota(IQ)				
	General	North Coast	South Coast		General comments	Licence	# licences		Coastwide TAC	IQ	North Coast TAC	South Coast TAC	Quota overage permitted
1994	Voluntary Individual Quota (IQ) program instituted by industry. Landings validated by independent company hired by PUHA. Management plan more detailed. New logbook requirements. Export requirements.	New timing and allocation of quota to areas.		New South Coast closures and study area.	Area licensing – North and South Coast, divided at Cape Caution. Annual area selection.	Z	110	min.100mm			5,896.7 tonnes (plus exploratory)	1,543 tonnes (plus exploratory)	
1995	Voluntary IQ program continues. Notification and catch reporting program established. PUHA research fund established.	Schedule of openings established to disperse fishery throughout year. Charter patrolman on the grounds January to April and October to December.	South Coast quota reduced to compensate for an overage in 1994.	New closures in North Coast.		Z	108	min.100mm			5,445 tonnes	1,387 tonnes	
1996	Two year IQ pilot program. Vessel length restrictions waived. Industry funded catch monitoring and validation program. Catch validation at first point of landing required. Designated landing ports. Fishing notification requirements. Quota overage, transfer and relinquishment requirements.	Schedule of openings. Charter patrolman on grounds for 8 months.	Minimum 3 vessels hailed before area opens.	New research area closures.	Licence stacking to max. of three per vessel. All but Native Band licences transferable.	Z	109	min.100mm	6,624.4 tonnes (14,604,000 lb.)	60.2 tonnes (132,763 lb.).	5,359.7 tonnes	1,264.6 tonnes	Up to 150 lb.
1997/98	IQ pilot continues. Catch validation. 18-month fishery to facilitate a change to licensing year. Harvest log and Validation log amalgamated. Chart records required. New container marking requirements.	Two licences reassigned to the North Coast - total 91.	Two licences reassigned from the South Coast - total 19. Decrease in TAC.	Four new closures: SAs 17-4 to 17-9, SAs 18-7 and 18-8, ptn. SA 5-10, ptn. SAs 24-9 and 24-11.		Z	110	min.100mm	9,851.4 tonnes (21,718,280 lb.)	89.6 tonnes (197,439 lb.)	8,150 tonnes	1,702 tonnes	Up to 200 lb.
1998/99	IQ pilot continues. Management plan August, 1 1998 through June 30, 1999. Product must be offloaded before moving to new area.	"Block System" used to manage area openings.		Six new closures: SAs 1-2 and 101-2.	Licence year July 1 to June 30. New licence redesignation and stacking procedures.	Z	110	min.100mm	5,603 tonnes (12,349,150 lb.).	50.9 tonnes (112,265 lb.)	4,635.2 tonnes	967.8 tonnes	Up to 500 lb.
1999/00	IQ pilot continues.	New North Coast fishing protocol - fish each area to completion before moving.				Z	110	min.100mm	5,603 tonnes (12,349,150 lb.).	50.9 tonnes (112,265 lb.)	4,634.0 tonnes	967.5 tonnes	Up to 500 lb.
2000/01	IQ pilot continues. Reduction in size limit and TAC. Plant sampling to assess the reduction.	New fishing protocol continues.				Z	110	min.90mm	4,885.9 tonnes (10,771,533 lb.)	44.4 tonnes (97,923 lb.)	4,042.0 tonnes	843.9 tonnes	Up to 500 lb.

3.2. Green Sea Urchin (2000/2001) – E. Wylie and G. Parker

3.2.1. Introduction

The green sea urchin (GSU), *Strongylocentrotus droebachiensis*, dive fishery began in 1987. The fishery in BC has gone through three periods: a 'developing period' during which effort and landings increased but catch per unit of effort (CPUE) declined; a 'crisis period' during which effort and landings peaked and CPUE reached a minimum; and a 'sustainable period' during which effort and landings have stabilized and CPUE has increased Perry *et al.*(2002). The fishery was managed with few restrictions until 1991, when licence limitation was introduced to control effort, followed by quota limitations in 1994 and an individual quota system with dockside validation in 1995. Total landings in the 2000/2001 fishing season were 181 tonnes with a landed value of approximately one million dollars. Unlike red sea urchins, where roe is extracted in BC, GSU are shipped whole and alive to Japan. The product quality and perishability has restricted the fishery primarily to accessible south coast areas.

The GSU fishery is currently managed by a minimum test size limit of 55 mm, precautionary quotas, and time and area openings as well as permanent area closures. The minimum size limit allows the GSU to spawn at least once before recruiting to the fishery.

Little biological data or stock assessment data exists for green sea urchins. Stock assessments were conducted by Harbo and Hobbs (1996), Perry *et al.* (1995), and Perry and Waddell (1998). Recent collaborative surveys produced useful biomass estimates for comparison with fishery data. They should be expanded to local "hot spots". In particular, surveys in the South Coast - southern region are recommended to assess stock status and trends in those locations. Information on green urchin larval biology and recruitment is needed to identify recruitment pulses and changes in the size structure of the population. Rapid and broad-scale survey methods are needed to assess green urchin distributions and stocks in unexploited areas (Perry and Waddell 1999).

3.2.2. Overview of the Fishery

3.2.2.1. Participants

A personal ZA licence is required to participate in the commercial green sea urchin fishery. The number of eligible ZA licences is limited to 49. Currently there are no licences assigned to First Nations through the Aboriginal Fisheries Strategy program. Licence stacking is possible, with a maximum of 3 licences per vessel during the 2000/01 fishing season. Twenty-eight vessels reported landings (Table 3.2.1).

Green sea urchins are an important component of many First Nation's food, social and ceremonial requirements.

Recreational harvest of urchins, red and green, is regulated through the sports fishing regulations for the Pacific region. The daily limit is 12 urchins, with a possession limit of 24. A Tidal Waters Sport Fishing Licence is required.

3.2.2.2. Location of the fishery

Green urchins are fished in both the South and North Coast regions of British Columbia. In recent years, most of the harvesting has been limited to South Coast due to product quality and limited stock assessment information available for other areas of the coast. Major fishing areas include Areas 12, 13, 18 and 19 (Table 3.2.4). During this season within the North Coast, Area 4 was the only area opened to green sea urchin harvesting under exploratory protocol. Areas of the coast where quotas are not established in the fishery management plan can be opened to licensed vessels which have applied to fish under an exploratory protocol. The protocol is available through DFO and requires onboard observers and surveys to determine biomass prior to fishing.

In 2000/01, all of the 49 licences, stacked on 28 vessels fished in the South Coast region.

3.2.2.3. Time Frame

The fishery runs for approximately four months, from November 10 to March 15 of the following year, subject to area quotas being achieved. The licence year for this fishery extends from June 1 to May 31 the following year. This licence schedule was established to allow the fishery to proceed during the peak market times of October to February, and re-issuing of licences to occur during the off-season summer months. Historically, December is the month when the fishing peaks. Quality is good and the demand rises. By the end of January, the landings start decreasing. At that time, the quality of the product declines as the GSU begin their spawning cycle.

3.2.2.4. Landings/ Value/ Markets

Green sea urchins are exported whole and live to Japan for final processing of the "roe". A processor can pack about 10,000 lbs. (4.5 t) of green sea urchins in 2 hr for air shipment. The sea urchins reach Japan about three days after harvest, and once processed, the roe can be held up to 15 days before it is marketed. Many processors undertake a test for roe recovery before shipping. There is a 15% recovery (roe wt./total wt.) overall but about a 6% recovery for the A-B grade. Green sea urchins are graded A-B (orange-yellow) or C-D (brown-dark brown), depending on colour and roe recovery.

In 2000/01 landings were 181 tonnes, slightly less than the quota of 193.9 tonnes. No harvesting occurred in the north coast regions, including Area 4, due to issues raised by local First Nations. There were also no landings out of Area 11. Area 11 has a high degree of exposure to weather and is a greater distance from landing ports. This accounts for most of the shortfall of the remaining coastwide quota.

There has been a steady increase in the CPUE since the 1995/96 season (Table 3.2.1). This might indicate that the fishery is still recovering from the 'crisis period' (1991 to 1993), (Perry *et al.*, 2002; Perry and Waddell 1999). In the 2000/2001 season the CPUE was at its highest level since 1990 at 107 kg per diver hour.

During the 2000/2001 season, 6 companies shipped a total of 181 tonnes of green sea urchins overseas. The value of green sea urchins was on average $2.45 per pound, a decrease of approximately ¢35 from the previous season. The drop in value is likely due to other countries flooding the market with product. The landed value of the overall fishery was just under one million dollars (Table 3.2.1).

3.2.2.5. Consultative Process

Fisheries and Oceans Canada consults extensively with all user groups on the management of the green sea urchin fishery. Representatives from First Nations, commercial licence holders, sport fishers, and other groups are invited to attend annual sectoral meetings with DFO to provide advice on the development of future management plans.

In addition to consultations regarding the management of the fishery, DFO also holds annual meetings to plan the annual research and stock assessment programs.

Programs often include joint participation from First Nations, commercial licence holders, and DFO.

3.2.2.6. Management Styles

A minimum legal size of 55 mm (test diameter) was established in 1988 to allow green sea urchins to spawn at least once, and because of market preferences for larger animals. Licences were limited in 1991 as a result of increasing effort. Currently there are 49 licences eligible for this fishery. Despite licence limitation, however, effort remained high and catch per unit effort (CPUE) continued to show a decline in most south coast areas until only recently. This decline in CPUE necessitated a more conservative approach to establishing quotas and resulted in an annual total allowable catch (TAC) in the south coast of 449 tonnes for 1994, 173.4 tonnes in 1995/96, and 166.1 tonnes during the 1996/97 to 1998/99 fisheries. In 1999/2000 fishing season, the quota was increased to 193.9 tonnes, which remained the quota for the 2000/2001 season.

In 1995, a two-year pilot program of individual quotas (IQ's) was implemented in the green sea urchin fishery. Under the pilot, an industry funded catch validation and monitoring program was put in place to ensure monitoring of quotas and recovery of accurate catch data. During the first year of the pilot, South Coast quotas were allocated equally among the licence holders (7,802 lb.), while the North Coast remained as a competitive fishery. During the second year of the pilot, equal IQ's were again applied to South Coast areas. IQ's have not been implemented in the North Coast and the area fished (Area 4) remains under an exploratory protocol.

Since 1996, the green sea urchin commercial fishery has been restricted to areas with a known catch history. To encourage the development of this fishery in a scientifically-based manner, Fisheries and Oceans Canada, in consultation with the West Coast Green Sea Urchin Association, has developed an exploratory fishing protocol. The protocol has been developed to allow expanded commercial harvest while collecting data to improve understanding of the resource. Applications to harvest green sea urchins under this protocol may be made by any ZA licensed vessel for any areas with no assigned fishing quota.

3.2.3. Stock Status

The green sea urchin fishery is considered "data limited". Information is required on wild growth, distribution (bed locations), juvenile recruitment, production, movement, and roe quality variables. The West Coast Green Urchin Association (WCGUA) and DFO have a collaborative agreement which includes research components. Research and biomass surveys are completed each year to further knowledge towards management and biological components of this species.

3.2.3.1. Biology, Environment, Habitat

The known distribution and biology of green sea urchins in B.C. is summarised by Harbo and Hobbs (1996), but is generally poorly understood. They occur intertidally and to depths of >140 m, generally on rocky, gravel or shell substrates. The South Coast stocks are typically in current-swept passages. Sexes are separate, with sizes at maturity of 25 mm in the Atlantic (Miller and Mann 1973) and from 35-45 mm in Alaska (Munk 1992). In B.C., the spawning period generally occurs during February and March, although there are indications that the West Coast Vancouver Island stocks may spawn earlier. Larvae are pelagic for 9-10 weeks depending on temperature (Strathmann

1978). Green urchin growth rates vary considerably depending on food availability, with rates of 1 cm yr^{-1} recorded for the Strait of Georgia (Foreman and Lindstrom 1974) and slightly >1 cm yr^{-1} in Alaska (Munk 1992). It takes approximately 4 years (Munk 1992) for a green urchin to reach a test diameter of about 55 mm (the minimum legal size in B.C.). Maximum test diameters can be >100 mm. Ageing of green sea urchins using rings on the coronal test plates and the rotules (components of Aristotle's lantern) has indicated that animals from the Bay of Fundy on the Atlantic Coast may be up to 25 years old (Robinson and MacIntyre 1997). Roe quality is strongly correlated to diet and food availability. Green sea urchins appear to be more mobile than Red sea urchins, and unpredictable (in space and time) aggregations are common. Green urchins may undertake deep-shallow migrations.

3.2.3.2. Assessment

A review of the available data, and an assessment of the stocks and determination of a biologically-based quota for this fishery was conducted by Perry and Waddell (1999) PSARC I99-07.

A service bureau was contracted to carry out a validation program and the WCGUA awarded the contract to D&D Pacific Fisheries Ltd for the 2000/2001 season. Fishermen must comply with licence conditions and provide log record of their fishing activity to assist DFO managers in acquiring data on the abundance and distribution of GSU. Vessel masters submit harvest charts to dock side validators at the time of off-loading. Starting in 1999/2000, D&D had to capture the fishing location electronically. The Shellfish Data Unit from the Pacific Biological Station continued to collect and process harvest logbook information for GSU fishery in 2000/2001. The Statistics Unit of DFO in Vancouver process and maintain the sales slip databases.

3.2.4. Research

Stock assessment surveys are conducted by industry and DFO. In recent years work has concentrated in Area 12, Stephenson Islets (Waddell *et al.* 1997). This program is designed to monitor and analyze the impacts of harvest on the local population of urchins.

From 1999 to 2001, there were biomass surveys in Area 12 (Stephenson Islets), Area 18 (Active Pass, Boiling, Cooper and Arachne Reefs), Area 20 (Sooke Bluff) and Area 4 (Hodgon Reef). These biomass surveys use the method described in Waddell *et al.* 1997.

Individual licence holders also have the opportunity to conduct exploratory survey work in areas not allocated a quota in the management plan through the Exploratory Fishing Protocol. Through the protocol, industry licence holders pay for an independent observer to participate in biomass surveys of a predetermined area, and are then permitted to harvest 10% of the legal sized biomass found in the survey area.

Dockside validators performed biological sampling of GSU landed from each vessel off-load. Twenty-five GSU are randomly collected from each off-load to collect size frequency data from the catch. In 2000/2001, the observers sampled 288 validations, amounting to 80% of all validations. In total 7,200 samplings were conducted.

For all subareas, the average size of urchins ranged from 60 to 72 mm. However, the maximum and minimum sizes show a much greater variation across subareas.

A study to outplant hatchery-reared juvenile GSU is underway. This study will assess the impact and feasibility of outplanting cultured juvenile GSU within natural populations.

3.2.5. Current Management Issues

Many of the issues related to controlling the management of the fishery and harvest quotas have been addressed through the introduction of the individual quota program with industry-funded catch monitoring programs.

It is important to continue to obtain more fisheries independent information on the local stocks of urchins.

Issues have been raised by some First Nations regarding stock abundance within their areas and the ability for the First Nations to access green sea urchins for their food, social and ceremonial requirements. Fisheries and Oceans Canada in conjunction with the West Coast Green Sea Urchin Association are working with local First Nations in the North Coast to develop and foster a better understanding between user groups of this resource.

There is a need to review and define validation procedures concerning penning or holding GSU in the ocean or on land-based sites as these options are becoming more used.

3.2.6. Fishery Management Measures

See Table 3.2.2. for a summary of current and historical management changes.

There were no in-season changes in the South Coast for the 2000/2001 season. The WCGUA established a protocol for ZA licensed vessels to register in the North Coast fishery. This in-season registration enabled the Association to split the quota by the number of vessels who registered.

The IQ program includes a 2% allocation of the TAC for aboriginal use with the remaining divided equally amongst all licences. Based on joint research surveys conducted by industry participants and DFO, the TAC in 2000/2001 season remained the same and was set at 427,393 lbs: 414,393 lbs for the south coast and 13,000 lbs for the north coast. The IQ program also requires the industry, the West Coast Green Urchin Association (WCGUA), to develop and fund a catch monitoring and validation program to ensure that area quotas and IQs are not exceeded. The program consists of verifying landings for all ZA licensed vessels, collecting accurate data, and disseminating the information in a timely manner.

3.2.7. Management Changes for 2000/2001:

- The south coast TAC was 414,393 lbs (188 t). Individual quotas were set at 8,457 lbs, equalling 1/49th of the south coast TAC. The North Coast TAC was to be fished as an exploratory area.
- A two year management plan was developed in consultation with Industry and First Nations. The plan is in effect from June 01/99 to May 31/2001.
- Areas 17 and 28 in the South Coast and Fraser River Management Divisions have been closed for the duration of the management plan.
- The fishery was limited to Areas 4, 11, 12, 13, 18, 19, and 20. Other areas of the coast may be opened, upon request, to be fished under an exploratory protocol developed by DFO, fishers and other interested parties.

3.2.7.1. Fishing Season

The licensing year, June 1 to May 31, allows the fishery to be open through Christmas and New Year's holidays to take advantage of peak market demand.

3.2.7.2. Control and Monitoring of Commercial Fishing Activities

There are a number of closures described in the Fishery Management Plan, primarily marine parks or areas of interest to sport divers. There are also research closures and several closures for native allocation and access.

As part of the DFO sanctioned Individual Quota system, which was implemented in 1995, industry is responsible for funding a dockside validation and monitoring program to track area of harvest and licence quotas.

3.2.7.3. Quota Allocations

Quotas are calculated from fisheries independent and fisheries dependent data for the main fishing areas along the coast. From this, 2% of the TAC is allocated to First Nations for food, social, and ceremonial use.

In 2000/2001, the commercial TAC for the coast was set at 193.9 tonnes. This was further broken down to area quotas as shown in Table 3.2.3. The quotas stayed the same from the previous season.

3.2.7.4. Other Relevant Elements

Licensing

Commercial harvesting of green urchins is licensed under a transferable personal ZA licence. Licences are limited at 49 and a maximum of three licences may be designated to any one vessel at one time. Annual licence fee to DFO is $430.

It is a condition of licence to maintain and provide to DFO an accurate record, a log, of daily harvest operations as well as a daily harvest chart record for each location fished by each diver.

Harvesting by First Nations is conducted under the authority of communal licences issued to bands.

Harvesting Techniques

Hand picking by divers is the only harvest method allowed. Suction devices or trawls used in other jurisdictions are not permitted in this fishery. Most of the harvest of green sea urchins occurs from small vessels using either SCUBA or surface supplied air for divers, usually in depths from 10 to 40 ft. The fishery has changed and groups of vessels, and vessels with multiple licences, fishing more remote areas with a packer are now more common.

3.2.8. Enforcement Issues and Strategies

The introduction of IQ management in the green urchin fishery has helped to decrease many of the major enforcement concerns. There continues to be some reported problems related to improper documentation and harvest log completion prior to validation. The number of situation reports written this season climbed from 17 to 33. This increase is explained by two factors, observers were instructed to write a situation report when section ‘C’ of the validation page was not filled out completely and the use of totes for landings (only cages were allowed for landing product).

In general, compliance of licence conditions in this fishery appears to be very high.

3.2.9. Financial Responsibilities

3.2.9.1. Industry

As part of the DFO sanctioned Individual Quota system, which was implemented in 1995, industry is responsible for funding a dockside monitoring program to track harvest of area and licence quotas.

3.2.9.2. DFO

DFO is responsible for stock assessment and management of the fishery.

3.2.10. Performance Review

3.2.10.1. Annual review (post season)

GSU fishery updates are completed on an annual basis and are reviewed by the Pacific Science Advice Review Committee (PSARC). DFO personnel involved with invertebrate fisheries, and other invited federal and provincial staffs, get together two or three times annually as a group, known as the Shellfish Working Group (SWG), to discuss shellfish issues. This forum allows for a review and discussions of specific issues from the GSU fishery and for all of the invertebrate fisheries.

Comments from participating fishermen from the D&D Pacific Fisheries Ltd. Year-end report:

- Additional surveys in the North coast and Central Coast are needed. Area 9 (Rivers Inlet), in particular, should be surveyed. This was also commented on last season.
- The Area 20 survey was delayed too long, resulting in vessels having to travel north unnecessarily to achieve their IQ. The survey should be conducted prior to the commercial season, and by vessels qualified to do the survey not selected vessels only.
- The voluntary closure of quota areas 17 and 28 by the WCGUA is still supported. The association anticipated these areas will be accessible again in the future. Again, research surveys play a key role in a proper reassessment of the quota within areas 17 & 28,
- Harvest from area 18 and 19 were good. Harvest rates seemed good and fishermen reported abundance of greens throughout the area as compared to last season – good recruitment.
- Too many vessels fishing the same spots in Area 12.
- Self-policing by the WCGUA worked well in deterring illegitimate activity this season, like fishing closed research areas. However, If DFO were on the grounds randomly throughout the season this would prove invaluable.

Comments from D&D (Service Bureau) from the D&D Pacific Fisheries Ltd. Year-end report:

- The use of totes as transport container needs to be addressed, it was very disorganized and at one point left a vessel grounded during its offload.
- The sampling program went well and samples were conducted at nearly all offloads. The Telegraph Cove landing port had occasions when pressure form truckers and buyers to complete the offload quickly prevented the sampling of some validations. Also in Telegraph Cove, a secondary offload site developed during the season

caused problems for observers when fishermen were demanding validation from two sites within one port. Poor weather and broken calipers also prevented a few samplings. In the past, it was often difficult to conduct the sampling in such a systematic manner.

- Increase in vessel activity in area 12 and 13 required more observers in the ports than in previous seasons to validate the product.
- Confusion over boundaries of closed research areas was prevalent and some fishers reported vessels fishing in the closed areas.
- Most vessel masters were more diligent in their hail notification prior to fishing or prior to landing product at designated ports than in previous seasons. Hail notification infractions seem to be limited to a few vessel masters who have a history of irregular hail procedures.

3.2.11. Literature Cited

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Table 3.2.1. Green sea urchin landings (tonnes) and effort for 1987 to 2000/ 2001 fishery seasons, as reported on harvest logs (tonnes; 1987 to 1994) or validation logs (1995 to 2001).

Year	Type and Number of Licences Issued	Number of Vessels with Landings	Fishing Days	Average Fishing Days/ Vessel	Quotas (t)	Landings (t)	Landed Value[3] ($·10³)	Whole Landed Value[1] ($/t)	$\bar{X}$ CPUE (t/vessel day)	$\bar{X}$ CPUE (kg/diver hr)	Total Diver Hours	Total # Divers
1987	Permit 38[2]	29	290	10.0		207	127	614	0.71	170	1,216	49
1988	Z 89	63	688	10.9		378	584	1,545	0.55	156	2,418	119
1989	Z 191	93	1,095	11.8		484	1,020	2,107	0.44	131	3,691	170
1990	Z 155	51	923	18.1		353	939	2,660	0.38	107	3,310	107
1991	Z 47	45	1,510	33.6		753	1,795	2,384	0.50	100	7,523	153
1992	Z 49	53	1,987	37.5		954	4,424	4,637	0.48	81	11,835	200
1993	Z 49	52	1,267	24.4		533	3,777	7,086	0.42	70	7,667	184
1994	Z 49	42	673	16.0	449*	221	2,122	9,602	0.33	70	3,161	102
1995/96	Z 45	39	500	12.8	173.4* 90.7**	157	946	6,027	0.31	71	2,201	86
1996/97	Z 49	32	458	14.3	166.1	150	942	6,282	0.33	65	2,300	73
1997/98	Z 49	27	423	15.7	166.1	160	1,004	6,277	0.38	82	1,958	59
1998/99	Z 49	26	376	14.5	166.1	156	967	6,200	0.41	84	1,851	61
1999/2000	Z 49	26	357	13.7	193.9	186	1,157	6,210	0.52	103	1,810	65
2000/2001	Z 49	28	314	11.2	193.9	181	978	5,395	0.58	107	1,689	56

[1] from sales slip data

[2] scientific permits were issued to 38 vessels for fall 1987 to spring 1988 fishery. Z licences were issued for the fall 1988 fishery.

[3] Average Whole Landed Value ($/t)[1] * Landings (t)

* south coast quota only, ** north coast quota only

2000/2001 landing data preliminary

Note: Number of vessels with landings is greater than the industry report as licences were re-designated to different vessels inseason.

Table 3.2.2. Summary of Management Actions in the green sea urchin fishery, 1987 to 2000/01.

Year	Management Actions
1987	Scientific permits were issued, July 22 to December 31, to fishing vessels for harvest by diving. Logbooks were issued with permits to collect data on stock abundance and distribution. Permits were limited to the inside waters of Vancouver Island, Areas 12 to 19, 28 and 29. Some minor area closures for parks or study areas were in effect as for most dive fisheries. A precautionary minimum size limit of 40 mm was set as a condition of the permit. Sales slip data did not have a separate species code, so green and red sea urchin landings are mixed. As a result, landings have been estimated from logbook returns and hails from processors. Effort was restricted by limiting the season to the months of traditional peak market demand for sea urchins, Oct.-Dec. and Jan.-Feb. Nineteen vessels reported landings.
1988	Sales data for green sea urchins was recorded with a separate species code. A conservative closure was set, Jan. 16 to Feb. 28 in subareas 13-1 to 13-3 due to the intensive fishery in a small area. A Z category (Z-A) licence for green sea urchins was introduced for the fall fishery which opened Oct. 1. The minimum size limit was increased to 55 mm test diameter and set as a condition of licence. The season was limited again, Jan. 1-Feb. 28 and Oct. 1-Dec. 31. Sixty-eight vessels reported landings.
1989	The ZA licence, minimum size limit and seasonal restrictions continued. A conservation closure was set for subareas 12-1 and 13-29 to 13-40, north of Campbell River, Jan. 31-Feb. 28/89 due to heavy fishing pressure and a high incidence of undersized urchins landed. One hundred thirteen vessels reported landings.
1990	The ZA licence, minimum size limit and seasonal restrictions continued. Licence limitation for 1991 was announced with the eligibility criteria of landings of 9,072 kg (20,000 lb.) over the two year period 1988 and 1989. At least 33 vessels were expected to qualify before appeals were held. There were 91 vessels reporting landings.
1991	Licence limitation - 47 vessels qualified and 47 vessels reported landings.
1992	South Coast: A conservation closure was set in the Kelsey Bay area, subareas 12-1, 13-32, 13-33 and 13-35, Feb. 25-Feb. 28. These subareas did not reopen for fall fishing until Dec. 7. North Coast: Fishery open year round, no quotas.
1993	Licences increased to 49. Notification of fishing required. No suction devices. Additional permanently closed areas for parks and reserves. South Coast: Reduced fishing times; Inside waters: season Jan. 4 to Jan. 28, 7 days/wk; Feb. 1 to Feb. 25, 4 days/wk, Mon.-Thurs. Fall fishery Nov. 1 to Dec. 16, 4 days/wk, Mon.-Thurs.; Dec. 6 to Dec. 30, 7 days/wk. Kelsey Bay limited to 7 days, Jan. 4 to 10. W.C.V.I.: season reduced to Oct. 4 to 28, 1992, 7 days/wk. North Coast: 7 days/wk, season reduced to Jan. 1 to Feb. 28 and Oct. 1 to Dec. 31.
1994	South Coast: A ceiling catch of 990,000 lbs (449 t) was set along with area quotas. Fishers requested to harvest 25% in Jan.-Feb. and the balance in Nov.-Dec. The days fishing were limited to four days/week (M-R) for some periods and others at 7 days/week. North Coast: No quota set; season reduced to periods Jan. 1 to Feb. 28 and Nov. 1 to Dec. 31. Consideration will be given for spring/summer fisheries depending on roe quality and landings.

Table 3.2.2. continued

1995/96	Fishing licences changed to expire on May 31, 1996. No fishing occurred prior to Nov. South Coast: Pilot individual licence quota (IQ) system implemented with port validation. Area quotas also established, with total of 382,276 lb (173.4 t). Only Areas 12, 13, 17 to 20, and 28 open; other areas available under an exploratory protocol. Fishing season was Nov. 20, 1995 to May 31, 1996. North Coast: No individual quotas. Areas 3 and 4 only open from Nov. 20, 1995 to Jan. 31, 1996, with quota of 20,000 lbs (90.72 t). Other areas open to fishing only under an exploratory protocol.
1996/97	Harvest logs and validation forms combined onto one sheet. Biosamples (sample test measurements) collected by validators. South Coast: IQ system still in effect (quota divided between 49 licence holders), with port validation. Area quotas established, with a total of 359,435 lb (163.0 t). Only Areas 11, 12, 13, 17 to 20 and 28 open; other areas available under an exploratory protocol. Fishing season was Nov. 12, 1996 to Jan. 31, 1997 North Coast: North Coast closed, except under an exploratory protocol.
1997/98	Two year Management Plan (October 15, 1997 to May 31, 1999). Biological sampling of commercial catch. South Coast: Areas 11, 12, 13, 17 to 20 and 28 open from Nov. 10, 1997 to Mar. 15, 1998. Area quotas, with total of 366,079 lb (166.1 t) (IQ 7,471 lbs).. North Coast: North Coast closed, except under an exploratory protocol. Survey undertaken in Area 4.
1998/99	Biological sampling of commercial catch. South Coast: Areas 11, 12, 13, 17, 18, 19, 20, and 28 open from Nov. 10, 1998 to Mar. 15, 1999. Area quotas, with total of 366,079lb (individual quotas 7,471 lb), other areas available under an exploratory protocol. North Coast: Total quota of 13,000 lbs allotted to Area 4 from Nov. 10, 1998 to Mar. 15, 1999, other areas available under an exploratory protocol.
1999/00	Biological sampling of commercial catch. South Coast: Areas 11, 12, 13, 18, 19, and 20 open from Nov. 10, 1999 to Mar. 15, 2000. Area quotas, with total of 427,393 lbs (individual quotas 8,457 lbs), other areas available under an exploratory protocol. North Coast: Total quota of 13,000 lbs allotted to Area 4 from Nov. 10, 1999 to Mar. 15, 2000, other areas available under an exploratory protocol.
2000/01	Biological sampling of commercial catch. South Coast: Areas 11, 12, 13, 18, 19, and 20 open from Nov. 10, 2000 to Mar. 15, 2001. Area quotas, with total of 427,393 lbs (individual quotas 8,457 lbs), other areas available under an exploratory protocol. North Coast: Total quota of 13,000 lbs allotted to Area 4 from Nov. 10, 2000 to Mar. 15, 2001, other areas available under an exploratory protocol.

Table 3.2.3. Green sea urchin quotas and landings for the 2000/01 fishing season.

Management Areas	Quota (t)	Quota (lbs)	Landings [1] (t)	Landings [1] (lbs)	Open Date	Quota Achieved Date
4	5.9	13,000	0.0		10-Nov-00	-
11	4.8	10,493	0.0		10-Nov-00	-
12	105.2	231,900	104.4	230,240	10-Nov-00	-
13	56.2	124,000	56.3	124,042	10-Nov-00	4-Jan-01
18	9.1	20,000	9.2	20,326	10-Nov-00	20-Dec-00
19	9.1	20,000	9.1	19,990	10-Nov-00	17-Dec-00
20	3.6	8,000	2.3	5,073	10-Nov-00	-
Totals	**193.9**	**427,393**	**186.6**	**411,398**		

[1] - Landings are from validation logs

Table 3.2.4. Summary of green sea urchin landings (tonnes) by South Coast Management Areas as reported on harvest logs (1987 to 1994) or validation logs (1995 to 2001).

PACIFIC FISHERY MANAGEMENT AREAS

	East Coast Vancouver Island													**West Coast Vancouver Island**					
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	Annual Landings
1987		#	108.5			#		12.7	57.8	#	#	#					#		207.3
1988	#	63.6	162.7				#	70.3	50.2	5.0	12.8	3.2			#				377.0
1989		217.6	89.7	#	#	#	6.7	88.1	22.5	#	7.8	6.0			#			#	453.0
1990		103.3	105.9					32.3	90.4		0.4	14.1							346.4
1991		353.7	206.1	#			#	23.1	66.3	#	#	76.1			#				752.3
1992	70.8	631.4	154.1			#	#	26.0	38.6	#	#	26.7							953.9
1993	27.6	214.1	92.6			#	1.7	39.9	46.3	#	#	16.9							440.3
1994	6.9	92.6	53.6				#	15.1	16.0			10.8							195.2
1995/96	0.7	60.5	54.8	*	*	*	#	12.2	18.3		#	6.1	*	*	*	*	*	*	153.1
1996/97	#	77.0	27.0	*	*	*	*	18.1	17.4		#	7.1	*	*	*	*	*	*	149.8
1997/98	2.4	76.5	39.9	*	*	*	0.7	16.3	17.4		*	6.8							160.0
1998/99	0.7	76.6	39.8	*	*	*	#	14.9	16.7		*	6.6	*	*	*	*	*	*	#
1999/2000	#	105.5	56.3	*	*	*	*	8.8	9.0	*	*	#	*	*	*	*	*	*	186.3
2000/2001		104.4	56.3	*	*	*	*	9.2	9.1	*	*	2.3	*	*	*	*	*	*	181.3
Totals	**115.9**	**2,178.6**	**1,247.3**	**1.6**	**0.1**	**5.3**	**14.0**	**387.0**	**476.0**	**25.5**	**52.4**	**186.6**	**0.0**	**0.0**	**5.0**	**0.0**	**4.3**	**11.9**	**4,711.5**

* Areas were closed after 1995 and could only be fished under an exploratory protocol

# - Landings do not meet confidentiality requirements.

3.3. Sea Cucumbers – J. Rogers and T. Johansson

3.3.1. Introduction

Little is known of the biology and abundance of the giant red sea cucumber (*Parastichopus californicus*) in British Columbia and therefore the fishery has been designated by the Department as being "data-limited". As such, a precautionary approach to the management of this fishery has been adopted through an adaptive management plan. The key scientific requirement in the development of precautionary management strategies for data-limited or "developing" invertebrate fisheries has been identified as information on the abundance, distribution and productivity of the species (Perry *et al.* 1999).

The life history characteristics of importance to understanding the productivity of Pacific Coast sea cucumber species are largely unavailable. No method has yet been found to age the animals, and therefore basic parameters for stock assessments (natural mortality, growth rate and age at recruitment) are speculations.

Giant red sea cucumbers undergo annual fluctuations in body mass, skin thickness and muscle weight from their yearly cycle of re-absorbing and re-generating their internal organs. These fluctuations may not have an effect on productivity, however they may have a significant effect on the quality of the market products. Timing of the commercial fishery is therefore important to optimize return.

Additional information on the biology of giant red sea cucumbers is provided in the Sea Cucumber Stock Status Report available from the Pacific Region Stock Assessment Division or the Internet at: http://www.pac.dfo-mpo.gc.ca/sci/psarc/SSRs/ssrs.htm.

3.3.2. Overview of the Fishery

Sea cucumbers are fished under the authority of a limited category "ZD" licence. These animals are harvested commercially by divers who remove the animals from the substrate by hand. Marketable products include frozen muscle strips and dried skins. Skins are semidried in B.C. and the U.S. prior to export to Asia. Final destinations for these products include Hong Kong, Taiwan, Mainland China and Korea, as well as Canada and the U.S.

Commercial exploitation of sea cucumbers began in BC in 1971 when the first landings were recorded. An experimental fishery occurred in southern waters during the early 1980s during which time markets were established for this product. As a result, there was a rapid escalation in effort during the 1980s which led to conservation concerns and the implementation of various management actions, including precautionary area quotas and reduced fishing times. To address the excessive effort in the fishery, licences were limited to a total of 85 in 1991.

Due to continuing conservation concerns in some areas, the difficulty in managing the fishery to specific area quotas, the rapid, intensive and often dangerous nature of the fishery and quota over runs in many areas in most years, the Pacific Sea Cucumber Harvesters Association (PSCHA) worked with the Department to implement an individual quota (IQ) program. Rather than implement a voluntary program (as done in red sea urchins), the sea cucumber industry waited until the Minister of Fisheries and Oceans Canada sanctioned a pilot IQ management regime for the sea cucumber, red sea urchin and green sea urchin fisheries in late 1995. The pilot program was established with several requirements. Two percent of the total allowable catch (TAC) is to be allocated for First Nations' food, social and ceremonial use. The remaining TAC is to be divided equally among commercial licence holders. Fishers are required to develop and fund a catch monitoring and validation program to ensure that area quotas and IQs are not exceeded (see Section 3.3.4.).

The commercial fishery is currently managed through limited entry licensing, area licensing, a precautionary fixed exploitation rate, area quotas and an IQ program. There are 85 licence eligibilities for this fishery. Sea cucumber licence quotas are set at 1/85 of the annual coast-wide commercial TAC, and fishers are required to select one of four licence areas in which to fish. These management tools are described in more detail in Section 3.3.4.

To address the data limited nature of this fishery and the continued commitment of the Department to move towards more precautionary fisheries management, an adaptive management plan was developed and implemented for the sea cucumber fishery in 1997. Under this management approach, the Department has restricted the commercial fishery to approximately 25 percent of the total coastline in non-contiguous areas. A further 25 percent of the coastline is reserved for research purposes, and the remaining 50 percent of the coastline will not be harvested until information on the biological characteristics of the sea cucumber is collected and a biologically-based management plan can be developed (see Section 3.3.2.2.).

Sea cucumbers are of continuing importance to First Nations, who harvest for food, social and ceremonial use.

A small recreational fishery occurs for sea cucumbers in most coastal areas.

3.3.2.1. Participants

A personal "ZD" licence designated to a registered fishing vessel is required to participate in the commercial sea cucumber fishery. The number of eligible "ZD" licences was initially limited to 78 but has grown to 85 through successful licence appeals and the addition of five commercial band licences issued to coastal First Nations.

The Department negotiates approximately 74 agreements annually with 145 First Nations in BC and the Yukon. Several of these agreements include provisions for the harvest of sea cucumbers for food, social and ceremonial purposes. The level of harvest is unknown at this time. First Nations access to fish for food, social and ceremonial purposes are managed through a Communal Licence. Opportunities for First Nation participation in the commercial sea cucumber fishery is provided through the Licence Retirement/Allocation Transfer Program. For more information on fisheries agreements, communal licences and the Licence Retirement/Allocation Transfer Program see Section 3.3.4 Management Styles.

A British Columbia Tidal Waters Sport Fishing Licence is required for recreational harvest of sea cucumber. The number of sports fishers who participate in the fishery is unknown.

There are eight buyers and registered processors involved in the B.C. commercial sea cucumber industry. These facilities are located in Vancouver, Bella Bella, Klemtu and Prince Rupert.

3.3.2.2. Location of the fishery

Recent

The commercial sea cucumber fishery occurs in four geographic areas: West Coast Vancouver Island (Area 24), East Coast Vancouver Island (Area 12 and 13), Central Coast District (Area 7, 8 and 9) and Prince Rupert District (Area 4, 5 and 6). The fishery is prosecuted in those Subareas within the four geographic areas whose combined shoreline length totals approximately 25 percent of the total B.C. shoreline (see Sections 3.3.4.1 and 3.4.2).

Aboriginal Communal Licences specify the locations permitted for use by Coastal First Nations for food, social and ceremonial harvests. However harvesting generally takes place in areas fronting or adjacent to reserves.

Recreational harvest of sea cucumbers occurs coastwide. Harvest guidelines are provided in the B.C. Tidal Waters Sport Fishing Guide.

Experimental fishery and permanent area closures are listed in the Catch Harvest Plan of the 2000 Integrated Fisheries Management Plan. These closures restrict commercial fishing activity only and have no impact on the location of First Nations' or recreational harvest.

Historical

In 1993, commercial quotas were assigned to five geographic areas: West Coast Vancouver Island, East Coast Vancouver Island, Central Coast, Prince Rupert District and the Queen Charlotte Islands, within which Pacific Fishery Management Subareas were opened on a three year rotational basis. The rotational fishery was aimed at reducing the possible localized impacts of harvesting by allowing a two-year recovery period between openings. In 1992 and 1993, the open areas in the Central Coast District were restricted in order to move the fishery from heavily harvested locations in Area 7 and to better focus management efforts in-season. In 1994, open areas were restricted in the other North Coast Districts as well. Appendix 3.3.3. shows the open areas from 1986 to 2000. Following a review in 1996, the rotational-style fishery was no longer used.

Following a 1996 working paper (Boutillier *et al.* 1998) and implementation of an adaptive management strategy for the sea cucumber fishery, Subareas comprising approximately 25% of the total B.C. coastline were designated for commercial harvest under the precautionary coastwide TAC.

The adaptive management approach applies a precautionary coast-wide commercial TAC to 25 percent of the B.C. coastline in non-contiguous harvest areas. A further 25 percent of the coastline is reserved for research and experimental harvest, which may be undertaken by commercial licence holders, First Nations and other stakeholders, under experimental guidelines developed by the Department. The remaining 50 percent of the coastline is excluded from any commercial harvest for the foreseeable future in support of the risk averse approach to this data limited fishery.

In 1997, open Subareas in the North Coast and South Coast were selected in consultation with the commercial industry and First Nations. North Coast and South Coast Subareas were selected to maintain the historical commercial TAC of 178.3 tonnes (393,185 lb.) split weight and 54.9 tonnes (120,980 lb.) split weight, respectively, based on recommended quotas from the Stock Assessment unit. Section 2 of the Catch Harvest Plan of the Integrated Fisheries Management Plan shows the Subareas currently open to the commercial fishery.

In 1998, managers used densities estimated from surveys to recalculate the commercial TAC and discovered that insufficient Subareas were open to provide for the historical 233.2 t (514,165 lb.) commercial TAC (the recommended quota for the open subareas was 439,120 lb.). Additional Subareas were opened, in consultation with the commercial industry and First Nations, and the areas for the 1998 fishery are shown in Appendix 3.3.3.

While these sea cucumber management areas are currently designated in the Prince Rupert District, Central Coast District and west and east coasts of Vancouver Island, select areas off the Queen Charlotte Islands (QCI) may also be designated for this use. Up to 1996, a commercial sea cucumber fishery occurred in a number of locations along the east coast of the Queen Charlotte Islands. Licences designated to these areas were re-designated to either the Central Coast District or Prince Rupert District as a result of higher costs associated with fishing and transporting sea cucumbers from QCI. Commercial fishers were advised that this area would remain within the commercial harvest plan and that fishing opportunities in these areas would be made available once biomass surveys are complete. This change to the management plan does not involve any increase in the annual commercial TAC.

3.3.2.3. Time Frame of the Fishery

Recent

Under the current management regime, the fishery generally lasts three weeks and most often occurs during October when product quality is higher and weather conditions are still conducive to fish. Individual quotas allow fishers to select optimum times in which to harvest without fear of competition from other licence holders. While some areas may be more desirable to fish in and those quotas harvested early, openings in most areas span the entire three week period.

First Nations and recreational fisheries occur year-round in all areas, or as described in the B.C. Tidal Waters Sport Fishing Guide for the recreational fishery. However, First Nation harvesting is mainly opportunistic associated with extreme tides.

Historical

Until the introduction of IQs in 1995, the duration of the commercial fishery had become very short. In 1993, openings were for only one or two days in all areas except the Queen Charlotte Islands, which was opened for eight days. In 1995, the fishery was scheduled to last two weeks in both the North and South coasts. Due to the late opening date, the fishery in the North was open for three weeks to allow for weather-related delays. In 1996, the fishery opened for two weeks. The East Coast Vancouver Island fishery was extended for three days and the Central Coast was re-opened for one day. Both of these extensions were to facilitate completion of quotas for specific licences.

Appendix 3.3.3. shows the wide variation in fishery opening dates and open periods from 1986 to date.

3.3.2.4. Landings, Value and Markets

Recent

Validated commercial landings of sea cucumber for 2000 were 371.9 t (819,804 lb.) split weight, slightly more than the commercial TAC of 370.1 t (816,000 lb.).

Preliminary data for 2000 indicate that the ex-vessel value of the commercial sea cucumber fishery was approximately $1.75 million. This represents an increase in value from the 1999 fishery that landed 347.8 t (766,857 lb.) split weight, valued at $1.1 million. Average price paid to the fishers in 2000 was $4.70/kg ($2.13/lb.) split weight. The commercial fishery ranks sixth in value among Pacific Region commercial shellfish fisheries.

Limited information on the extent of First Nations' and recreational harvest of sea cucumbers is available to the Department at this time. Catch monitoring programs are being developed in collaboration with Aboriginal organizations and the recreational fishing sector.

Historical

Appendices 3.3.1. and 3.3.2. summarize landings, effort and value data for the commercial fishery from 1980 to 2000. Quotas and landings prior to 1992 are reported in both round and split weights. Since 1992, all landings have been in split form and weights are recorded as such. Appendices 3.3.3. through 3.3.6. present the coastwide opening dates, open areas, quotas and landings for the most recent sea cucumber fisheries.

Fish slip information is reported in kilograms of round product, while harvest log information is reported in pounds of split and eviscerated product. The data have been converted to allow comparison of the information by year and area. There is a difference between validated weights of sea cucumber and those weights reported on fish slips. Landings are reported on fish slips by Area, whereas landings are reported on Validation & Harvest logs by Subarea.

When the IQ program was introduced, concerns for quota overages were reduced and fixed fishery duration was established. The pattern of exceeding coastwide quotas, which occurred each year between 1987 and 1993, has not occurred since 1994. Quotas were achieved in 1997 by all except one licence, where a lease agreement dissolved just prior to the opening date and the license was not fished. Minor overages and underages did occur between licences throughout the fishery, but the overall landings were lower than the assigned coastwide commercial TAC.

Validated landings for 1998 were 276.2 t (608,963 lb.) split weight, slightly more than the commercial TAC of 275.7 t. The ex-vessel value of the 1998 fishery was approximately $0.98 million. This is an increase in value from the 1997 fishery that landed 227.4 t (501,325 lb.) split weight, valued at $0.78 million. Average price paid to the fishers in 1998 was $4.60/kg ($2.09/lb., split and eviscerated weight). Since the implementation of individual quotas, the annual landed value has fluctuated between $2.86/kg and $4.40/kg, ($1.30/lb. to $2.00/lb., split and eviscerated weight), or approximately $1 million total ex-vessel value.

The South Coast quota in 1998 was 58.4 t (128,700 lb.) split weight. Eight vessels landed 58.7 t (129,340 lb.) (as reported on validation logs), 42.3 t from Inside Waters and 16.4 t from the West Coast of Vancouver Island. The North Coast quota was 217.3 t (479,050 lb.) split weight and 217.6 t (479,623 lb.) were landed. A small underage was recorded in the Prince Rupert District, and a small overage was recorded for the Central Coast District.

Validated commercial landings of sea cucumber for 1999 were 347.8 t (766,857 lb.) split weight, slightly more than the commercial TAC of 347 t (765,000 lb.). The ex-vessel value of the commercial sea cucumber fishery was approximately $1.1 million. This represents a decrease in value from the 1998 fishery that landed 276.2 t (608,963 lb.) split weight, valued at $0.98 million. Average price paid to the fishers in 1999 was $3.28/kg ($1.49/lb.) split weight.

3.3.2.5. Consultative Process

A consultative process was initiated for the sea cucumber fishery in 1989 and is a major part of the planning for the commercial fishery. The primary consultative body for sea cucumbers in B.C. is the Sea Cucumber Sectoral Committee. This committee includes representatives from Fisheries and Oceans Canada, commercial licence holders, processors, First Nations, B.C. Ministry of Fisheries and the Sport Fishing Advisory Board. Members of the PSCHA represent commercial fishers on this committee.

The Department regularly consults with individual First Nations on a bilateral basis on their fisheries for food, social and ceremonial requirements purposes as well as other activities (including proposed commercial, recreational fisheries or fishery closures) that might impact on their fisheries. It is the objective of the Department to enter into Fisheries Agreements with First Nations that set out the fishing arrangements including area of the fishery, harvest levels, gear to be used and the First Nations involvement in the management of their fishery. The Department also consults with groups of First Nations that share common fishing areas or in some cases, share common interests. Examples of the latter include watershed based committees such as the Fraser River Aboriginal Fisheries Forum, and the province-wide B.C. Aboriginal Fisheries Commission. To date, there has not been an agreed upon process to consult on a multi-lateral basis (First Nations, commercial and recreational).

The Sectoral Committee's primary mandate is to provide the Department advice with respect to issues important to the management of the sea cucumber fishery, such as developing commercial harvest plans, scheduling research activities, and investigating new management strategies. The Committee is not a voting body but allows for the Department to receive a broad range of advice from First Nations, stakeholders and other concerned parties on matters relating to the management of the fishery. The Department retains the decision-making authority regarding management of the fishery. The Sectoral Committee meets annually to review and provide advice regarding the proposed management plan.

Since the move towards more precautionary management in this fishery, commercial fishers and First Nations have collaborated with the Department to undertake research and studies to allow for a better understanding of the resource. The Research Subcommittee of the Sectoral Committee meets annually to review, discuss and advise on stock assessments, recent surveys and future studies proposed for sea cucumbers.

Fisheries and Oceans Canada encourages participation by all interested parties at both the Sectoral Committee and Research Subcommittee meetings. The Research meeting is generally held in the spring, while the Sectoral Committee meets in the summer to discuss the upcoming management plan.

Coastal First Nations are notified of the Sectoral and Research meetings by letter. All stakeholders have an opportunity to access Fishery Notices, which announce meetings and in-season management actions. Fishery Notices are available through the Internet at: http://www-ops2.pac.dfo-mpo.gc.ca/fnsreports/rptmain.cfm in hard copy at Department area offices or through subscription to the regional Operations Centre at (604) 666-0583 (there is a fee for this final service).

The primary consultative body for the recreational fishing community is the Sport Fishing Advisory Board (SFAB). The SFAB has representatives from all parts of the recreational fishing community (examples are the B.C. Wildlife Federation and the Sport Fishing Institute of B.C.).

Following input from the Sectoral Committee, the draft management plan is distributed to First Nations and other stakeholders (i.e. commercial industry representatives) for review and comment at least 30 days prior to the Department's internal finalization process. Stakeholder input to the draft management plan is finalized prior to August 10.

The final management plan, which incorporates advice received from stakeholders, is approved in the Pacific Region and published four weeks prior to the fishery opening. The management plan is made available to the public through the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/mplans/mplans.htm and in hard copy at Department area offices.

3.3.2.6. Management Styles

Commercial Fishery – Recent

An adaptive management plan was developed and implemented for the commercial sea cucumber fishery in 1997. This approach was based on advice from the Pacific Scientific Advice Review Committee (Boutillier *et al.* 1998).

Currently, the main management tools of the commercial sea cucumber fishery include limited entry licensing, area licensing, a precautionary fixed exploitation rate of 4.2 percent of estimated biomass, area quotas and an Individual Quota (IQ) program in which total quota is divided equally amongst licences.

Limited Licence Entry

A limited entry licensing scheme was implemented in 1991 and 78 licences were issued, a reduction of approximately 64% from the previous year. This action was taken to curtail the tremendous uncontrolled growth observed in the fishery. Licence appeals increased the number of licences to 85, and this level of participation has remained constant to date.

Area Licensing

The number of licences assigned to each licence area is based on the biomass estimates for the area. Once a coast-wide TAC is established, commercial licence area TACs are adjusted to ensure equal individual quotas coast-wide. Based on the most recent stock assessment information available, 37 licences are assigned to the Prince Rupert District, 30 licences to the Central Coast District, 14 licences to the East Coast of Vancouver Island and four licences to the West Coast of Vancouver Island.

The PSCHA provides Fisheries and Oceans Canada with a list of licence area selections. If the PSCHA is unable to provide the licence area selections, the Department will determine area designation through a process of voluntary placement and lottery out of the over-subscribed area.

Precautionary Fixed Exploitation Rate

Under the precautionary management plan, Stock Assessment biologists and fishery managers used the most conservative information available from Alaska and Washington State to establish a coastwide mean density of 2.5 sea cucumbers per metre of shoreline. A conservative exploitation rate (also based on information from Alaska and Washington) of 4.2 percent is applied to the estimated stock in each harvest area to determine the annual TAC.

Surveys and studies are undertaken collaboratively by the PSCHA, First Nations and Fisheries and Oceans Canada in both the open and experimental harvest areas. Density estimates from surveys in open commercial harvest areas may be applied to the commercial TAC calculation using the 4.2% exploitation rate. The commercial TAC calculated from the measured densities is applied only to those Subareas surveyed. The harvest area commercial TACs, whether calculated from the precautionary estimated density, or the measured densities from surveys, are considered conservative and sustainable.

Total Allowable Catch and Area Quotas

Since 1987, area quotas and time and area openings have formed the basis for managing the commercial sea cucumber fishery. Individual quotas were implemented in 1995. The adaptive management plan, while it incorporates these management tools, allows for a significantly more precautionary approach to the fishery while information pertaining to the resource is accumulated.

In conjunction with area licensing, the coastwide commercial TAC is divided into area quotas. The TAC for each Quota Area is calculated from the density estimates and quotas provided by the Department's Stock Assessment Unit. Sea cucumber quota management areas are comprised of Pacific Fishery Management Areas, Subareas, or a combination of portions of Subareas.

The TAC for the open harvest areas is calculated using the density estimates, the exploitation rate, the shoreline length and an average split weight of sea cucumbers (see the catch harvest plan of the IFMP).

Individual Quota (IQ) Program

Individual quotas were formally implemented for the November 1995 sea cucumber fishery. Catch validation at the first point of landing is required and an industry-funded monitoring and validation program has been developed collaboratively between PSCHA, Fisheries and Oceans Canada and D&D Pacific Fisheries Ltd. Licence conditions ensure that all fishers participate in the pilot IQ program. Overall, the IQ program has resulted in a more orderly fishery. Industry funds this management program and other research programs through fees paid to PSCHA by association members.

Commercial Fishery – Historical

Commercial exploitation of sea cucumbers began in British Columbia in 1971 when the first landings were recorded. A scientific fishery occurred in southern waters during the early 1980s during which time markets were established for this product. As a result, there was a rapid escalation in effort during the 1980s which led to conservation concerns and the implementation of various management actions, including precautionary area quotas and reduced fishing times. To address the excessive effort in the fishery, licences were limited to a total of 85 in 1991.

Historically, the commercial sea cucumber fishery has been managed through precautionary arbitrary area quotas, IQs and area closures. Appendix 3.3.7. shows management actions by year.

North Coast quotas were initiated in 1986 with an arbitrary cap of 183 tonnes split weight. In 1989, the North Coast quota was split into three smaller quotas for the Central Coast District, Prince Rupert District and the Queen Charlotte Islands.

PSARC has recommended a series of quota reductions since 1986 until more is known about the growth and productivity of sea cucumbers. The commercial TAC was gradually reduced from 1,500 tonnes whole weight in 1986, to 575 tonnes whole weight (211 tonnes split weight) in 1994 as the Department adopted a more precautionary approach to this fishery.

Each of the two South Coast quotas were reduced from 55 tonnes in 1992 to 27.5 tonnes in 1993 and remained at that level through to 1996, except where quotas were reduced to compensate for previous overages. Fishers exceeded the quota set for Areas 12 and 13 by as much as three times in 1992 (Heizer and Hobbs 1994). In 1993, the Area 26 and 27 quota was exceeded by 13.5 tonnes and the Area 18 and 19 quota was exceeded by 3.5 tonnes. Overages were deducted in 1994, resulting in a quota allocation of zero tonnes for the Inside Waters (Appendix 3.3.1.).

Due to continuing conservation concerns in some areas, the difficulty in managing the fishery to specific area quotas, the rapid, intensive and often dangerous nature of the fishery and quota over runs in many areas in most years, the Department implemented an individual quota (IQ) program for the sea cucumber fishery as a two year pilot in September 1995. The pilot program was established with several requirements: two percent of the total allowable catch (TAC) is to be allocated for First Nations' food, social and ceremonial use; the remaining TAC is to be divided equally among licence holders; and fishers are required to develop and fund a catch monitoring and validation program to ensure that area quotas and IQs are not exceeded.

In 1996, the coastwide commercial TAC was 233.2 t (514,165 lb.) split weight and IQs equalled 1/85 of the commercial TAC, or 2.74 t (6,049 lb.) split weight. The South Coast quota was 54.9 t (120,980 lb.) split weight and the North Coast quota was 178.3 t (393,185 lb.) split weight.

To address the data limited nature of this fishery and the continued commitment for the Department to move towards more precautionary fisheries management, an adaptive management plan was developed and implemented for the sea cucumber fishery in 1997 (see Section 3.3.4). The adaptive management approach, while it incorporates management tools such area quotas and time and area openings, allows for a significantly more precautionary approach to the fishery while information pertaining to the resource is accumulated.

Aboriginal Fishery

The Department seeks to provide for the effective management and regulation of the Aboriginal fishery through negotiation of mutually acceptable and time-limited agreements which outline provisions pertaining to the fisheries and co-management activities. The agreements include provisions by which First Nations manage their members' food, social and ceremonial fisheries, in addition to outlining First Nation involvement in a range of co-management activities and economic development opportunities which may include, but not be limited to, habitat enhancement, catch monitoring and enforcement, fish management and community research. The First Nations' harvest of shellfish for food, social and ceremonial purposes is regulated through the *Aboriginal Communal Fishing Licences Regulations* made under the *Fisheries Act*. Communal licences are issued annually to First Nations under the authority of these regulations and include a mechanism for designating individuals and vessels to fish under the authority of that licence, outline the harvest area, any harvest or gear limitations, as well as the harvest reporting requirements. Communal licences can be amended in-season for resource conservation purposes. Even where an agreement cannot be concluded, Fisheries and Oceans Canada issues communal fishing licences to First Nations organizations.

It is the policy of the Department to encourage increased Aboriginal communal participation in and integration with coastal commercial fisheries. Aboriginal involvement in the fishery is a shared goal between the Department and Aboriginal people. It is a means to stimulate Aboriginal economic development opportunities and develop fisheries expertise in Aboriginal communities, while serving as the basis for more co-operation between Aboriginal communities and the commercial fishery sectors. Aboriginal participation in the commercial fisheries is being accommodated through the Licence Retirement/Allocation Transfer Program. The Fisheries and Oceans Canada Licence Retirement/Transfer Program (ATP) retires existing commercial licence eligibilities from fishers on a voluntary basis and re-issues these to eligible Aboriginal organizations as communal commercial licences (category "FZD" licences). The program has not yet retired any commercial sea cucumber licences.

For additional information on Communal Licences, see the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/afs/commlic.htm

For more information on the Aboriginal Fisheries Strategy (AFS) Licence Retirement/Allocation Transfer Program, see the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/afs/retire.htm

Recreational Fishery

The recreational harvest of shellfish is regulated through *the British Columbia Sport Fishing Regulations* made under the *Fisheries Act*. The Regulations are summarized annually in the British Columbia Tidal Waters Sport Fishing Guide which lists closed times and areas, bag limits and size limits (where applicable). If necessary, public notices are posted to document closures or changes from the Guide. Closures may be implemented in order to conserve vulnerable stocks, or to protect the public from consumption of contaminated shellfish or to meet Aboriginal food, social and ceremonial needs. For some species, areas have been closed to commercial harvest or commercial harvest openings have been delayed to provide an opportunity for the recreational community. The daily maximum sport limit for sea cucumber is 12, with a possession limit of 24.

3.3.2.7. Links with Coastal Planning and Management Initiatives

Oceans Management Strategy

Integrated Management (IM) of all activities related to estuarine, coastal and marine waters is a key long-term objective of the Department's Oceans Management Strategy for Canada. The Department is committed to ensuring wide consultation and collaboration in development and implementation of the Strategy. For further information visit their website at: http://www.pac.dfo-mpo.gc.ca/oceans

Integrated management and integrated fisheries management planning, share common objectives of adopting a precautionary approach, addressing ecosystem considerations, engaging a broad mix of interested stakeholders in management processes and facilitating sustainable development. In the future, IM planning processes will address the linkages between associated species management plans in a given geographical area, identify broad local interests, identify potential sites, objectives and management requirements for Marine Protected Areas (MPAs), and identify opportunities for ongoing monitoring of marine health.

In June 1999, four pilot MPAs were proposed for Pacific Region: Endeavour Ridge Hydrothermal Vents, Bowie Seamount, Race Rocks and Gabriola Passage. The impact of these proposed MPAs on Sea Cucumbers is unknown at present. A collaborative process will provide full opportunity for consultation with all interested parties as MPA development proceeds.

The provincial Land Use Co-ordination Office (LUCO) and Fisheries and Oceans Canada have agreed to work collaboratively on a unified process to address the coastal near-shore area of the Central Coast of BC. Currently, Fisheries and Oceans is participating in the provincially led Central Coast Land and Coastal Resource Management Plan initiative (CCLCRMP) (through Oceans Act Implementation). The products of the CCLCRMP include the identification of issues, values, general management objectives; strategic-level zones and sub-zones (including protected areas); specific management prescriptions and guidance for activities within each of the zones. It is anticipated that, subsequent to this process, Fisheries and Oceans Canada will initiate an Integrated Management process as part of Oceans Act Implementation. An Integrated Management process would be broad in scope, including all groups with an interest in the marine area.

The West Coast Vancouver Island Aquatic Management Board, a locally based management body, has been proposed for the West Coast of Vancouver Island. The Department is committed to negotiating a pilot Board before the end of 2000. This pilot provides a forum for the coastal communities and other persons and bodies affected by aquatic resource management to participate more fully with governments in all aspects of the integrated management of aquatic resources in the management area. Ample opportunity for advice from interested stakeholders will be provided as this initiative proceeds.

British Columbia Ecological Reserves

In respect of B.C. Ecological Reserves, the Department applies permanent fishing closures in those reserves with a marine component that may be impacted by this fishery.

Parks Canada

Harvesting is closed permanently in the Pacific Rim National Park and Broken Group Islands.

Gwaii Haanas National Park Reserve and proposed Marine Conservation Area encompasses the archipelago in southern Queen Charlotte Islands south of a boundary extending from Tasu Sound on the west and Tangil Peninsula on the east. On-grounds catch sampling is undertaken in the waters adjacent to the Gwaii Haanas National Park. Parks Canada and the Council of the Haida Nation jointly manage the park. Contact the Parks Canada - Gwaii Haanas National Park Reserve (P.O. Box 37, Queen Charlotte B.C. V0T 1S0; or visit the Internet at: http://www.harbour.com/parkscan/gwaii for information.

Selective Fishing

For the purposes of fisheries management in the Pacific Region, selective fisheries are defined by Fisheries and Oceans Canada as the ability to avoid known non-target species and stocks or, if encountered, to release them alive and unharmed.

In May 1999, the Department released a paper entitled Selective Fishing in Canada's Pacific Fisheries – A New Direction (Anon 1999). The paper outlines the objectives and strategies that form the basis of ensuring all fisheries in the Pacific Region become selective. With consideration of the comments and feedback received on this paper, the policy is being finalized for release in spring 2000. The paper and related information can be found on the Internet at: http://www-comm.pac.dfo-mpo.gc.ca/english/selective/.

The Canadian Code of Conduct for Responsible Fishing Operations

Canada played a leading role in the development of the UN Food and Agriculture Organization's (FAO) Code of Conduct for Responsible Fisheries. In 1994, the Canadian commercial fishing industry moved to create a Canadian code that would build on the international code, meet the unique needs of Canadian commercial fishers, and be built by the industry for the industry.

The Canadian Code of Conduct for Responsible Fishing Operations, designed by commercial harvesters, for commercial harvesters, provides operational standards and practical directions to aid in attaining responsible and sustainable harvesting operations for all commercial fishing operations in Canadian waters. The code encompasses 10 Conservative Principles, the foundations for conservation, and 36 Operational Guidelines, the ways to achieve conservation.

The Canadian Responsible Fisheries Board, made up of commercial harvesters, is responsible for overseeing ratification of the Code by commercial fishing organizations in Canada, and will work with the Department in implementing the Code through fishing, conservation and enforcement plans. The Board members were chosen by Canadian commercial fishers and represent the Atlantic and Pacific coasts, the Arctic and freshwater fisheries, and Aboriginal commercial fish harvesters.

In the Pacific Region, the following organizations have ratified the code as of December 1999: Deep Sea Trawlers Association of B.C., Area D Gillnet Association, Area E Gillnetters Association, Fishing Vessel Owners' Association of British Columbia, Pacific Gillnet Association, Pacific Trollers Association, Northern Trollers Association, B.C. Beam Trawlers Association, Underwater Harvesters Association, Pacific Urchin Harvesters Association, Pacific Halibut Management Association of British Columbia, Gulf Trollers Association, and Krill Trawlers Association.

The Code, and related information, can be accessed on the Internet at: http://www.responsiblefisheries.com

or from:

Secretariat, Canadian Code of Conduct for Responsible Fishing Operations
200 Kent Street, Station 13093
Ottawa, Ontario K1A 0E6
Tel: (613) 990-0157
Fax: (613) 990-9691
Email: secretariat@responsiblefisheries.com

Treaty Negotiations

Aboriginal access to fisheries and integration into the management of the fishery resource are important components of most land claims and self-government negotiations. Fisheries and Oceans Canada participates in these negotiations as part of the Federal team to achieve settlements which meet conservation requirements, satisfy Aboriginal aspirations regarding fisheries, and take into account the needs of third parties. Within Fisheries and Oceans Canada, Pacific Region, the Treaty and Aboriginal Policy Directorate represents the Department in Treaty negotiations with First Nations in both B.C. and the Yukon.

The lead Federal agency in B.C. Treaty negotiations is the Federal Treaty Negotiations Office (FTNO) of Indian and Northern Affairs Canada (Internet: http://www.inac.gc.ca). The other participants in these tripartite negotiations are the provincial government and First Nations. The B.C. Treaty Commission facilitates treaty negotiations in B.C. (Internet: http://www.bctreaty.net/). Yukon treaty negotiations have occurred under a separate Yukon Treaty process.

3.3.2.8. Aquaculture and Enhancement

The Department recognizes the aquaculture industry as a legitimate user of Canada's aquatic resources and will provide access to brood stock and seed stock for industry development purposes (growth and diversification), by scientific licence, on an as-needed basis, subject to conservation requirements. Requests to access the wild sea cucumber resource for development purposes must be supported by detailed project proposals, approved by the Department.

3.3.2.9. Policy

Proposed Pacific Region Interim Operating Guidelines Regarding Access to Shellfish for Aboriginal Harvesting

Fisheries and Oceans Canada is developing these guidelines in order to help the Department evaluate future requests submitted by Aboriginal people for management changes in commercial and recreational shellfish fisheries for the purposes of securing access to shellfish resources for food, social, and ceremonial purposes. These principles and proposed procedural guidelines will apply only to shellfish species in tidal waters.

Draft Pacific Region Policy on the Culture of Marine Invertebrates

A policy on the culture and enhancement of invertebrates in the Pacific Region is being developed and reviewed. Consultation will continue with the commercial industry, First Nations and other stakeholders.

3.3.3. Stock Status

The sea cucumber fishery is considered data limited and as such, a precautionary approach to management has been adopted.

The Department, in collaboration with First Nations and the PSCHA, is conducting ongoing research that will lead towards an improved understanding of the resource and a biologically based management plan.

3.3.3.1. Biology, Environment, Habitat and Species Interactions

The giant red or California sea cucumber (*Parastichopus californicus*) is a member of the phylum Echinodermata, which includes sea stars and sea urchins. It is the largest of approximately 30 sea cucumber species in B.C. and the only one that is commercially harvested. This species ranges from the Gulf of Alaska to southern California, in water depths from the intertidal to 250 m. Sea cucumbers occupy the seabed in a wide variety of substrate and current regimes, but are most abundant in areas of moderate current on complex boulder or bedrock substrates. Individuals have limited mobility, can travel up to 4 meters per day while feeding, and are reputed to undertake seasonal migrations to different depths. Sea cucumbers feed by picking up organic detritus with their mop-shaped adhesive tentacles as they move over the sea floor.

Sea cucumbers have separate sexes and spawning occurs from spring through summer. Eggs and sperm are released directly in the water and the developing larvae remain planktonic for two to four months. Juveniles grow from 0.25 mm at settlement to approximately 1 cm in one year and to 4 to 10 cm at the end of two years. During this early life-stage, they have been observed attached to the underside of rocks and in mats of stringy red algae in calm bays, although juveniles have been reported from many different habitats. Adult populations tend to be uniform in size and rarely contain individuals less than 15 cm. Age at recruitment to the fishery is thought to be at least 4 years, since year-classes can be distinguished through analysis of length frequency data for only the first three years.

No method has yet been found to age sea cucumber, and so information on mortality and growth rates, age at sexual maturity and longevity is unknown. The body shape is plastic, and hence measurements of body dimensions are difficult to obtain. Furthermore, the animals undergo annual fluctuations in body mass, skin thickness and muscle weight from their yearly cycle of resorbing and regenerating their internal organs.

3.3.3.2. Assessment

A review of the existing information on sea cucumbers and an initial stock assessment with quota options, based on harvest logbook catch data, was conducted by Phillips and Boutillier (1995; PSARC Working Paper I95-14, Stock Assessment and Quota Options for the Sea Cucumber Fishery). In this working paper, recommendations were made for improvement of the sea cucumber database, reduction of quota management area sizes, increase in provision of biological information (both fishery-dependent and fishery-independent), and the collaboration of the Department and industry to collect the most useful data possible for the management of this fishery. Steps towards these recommendations have been made with the implementation of validated landings and the combination of the Validation and Harvest logs.

A second working paper (Boutillier *et al.* 1996), which outlined advice on management of the fishery, was reviewed by PSARC in 1996. Recommendations from the working paper were as follows:

- Implement the most conservative fixed exploitation management strategy for the sea cucumber fishery in B.C. waters.
- Keep the present management system of IQs and adapt the present quotas over areas that would sustain it according to conservative estimates of fixed exploitation as defined in the theoretical Phase 0 management plan.
- Break up the quotas into as small a spatial scale as logistically possible, e.g. management subareas.
- Do not allow expansion of the fishery until there is appropriate data collected for B.C. waters to determine the impact of the present fishery.

- Develop with industry a cost-neutral way of obtaining reliable data for the Phase 1 evaluation of the fishery.
- Address other research initiatives where logistically possible and implement in a cost-neutral fashion.

In 1997, this advice was incorporated into the collaborative agreement between the PSCHA and the Department, and the management plan reflected this move to a more biologically based fishery. Density and exploitation rate survey protocols were developed and industry initiated the first surveys late in 1997 and into 1998.

In 1997, under the new adaptive management plan, open Subareas were redistributed and quota allocated accordingly. The coast-wide commercial TAC was 233.2 tonnes (514,165 lb.) split weight and IQs equalled 2.7 tonnes (6,049 lb.) split weight. The quota for the South Coast increased slightly from the 1996 allocation to 57.6 tonnes (127,029 lb.) split weight and the North Coast quota decreased slightly to 175.6 tonnes (387,136 lb.) split weight.

Under the density survey protocol, transect surveys are conducted to improve estimates of density, and for the subsequent calculation of sea cucumber abundance. Survey results are used in the design of experimental fisheries in closed areas and to calculate modified quotas in areas open to the commercial fishery (Hand and Rogers 1999).

A transect survey was undertaken jointly by the PSCHA and the Heiltsuk Fisheries Program in open harvest areas near Bella Bella, (Subareas 7-15, 7-17 and 7-30), during May 1998. The lower 90% confidence interval of the density estimates for each Subarea was used to calculate changes to the commercial TAC for those Subareas for 1998. The densities obtained from 197 transects were 6.6, 13.4, 11.9 sea cucumbers per metre of shoreline in Subareas 7-15, 7-17 and 7-30, respectively. This contrasts to the conservative estimate of 2.5 sea cucumbers per metre of shoreline which is used in area quota calculations where no abundance data is currently available. By applying the measured densities to the commercial TAC calculation, the combined coastwide commercial TAC for 1998 was increased by 42.5 tonnes (18%) from the 1997 level. The methodology used for this and other sea cucumber surveys has been reviewed and approved by PSARC, and reported in:

Boutillier, J.A., Campbell, A., Harbo, R.M. and Neifer, S. 1998. Scientific advice for the management of the sea cucumber (*Parastichopus californicus*) fishery in British Columbia. p.309-340. *In* Gillespie, G.E. and Walthers, L.C. (eds.). Invertebrate Working Papers reviewed by the Pacific Stock Assessment Review Committee in 1996. Can. Tech. Rep. Fish. Aquat. Sci. 2221.

Campbell, A. and Cripps, K. 1996. Survey of sea cucumber populations in the Central Coast of British Columbia during 1993-94.

The 1998 coastwide sea cucumber commercial TAC was 752.7 tonnes whole weight (275.7 tonnes split weight.

In May 1999, the PSCHA completed a total of 236 transects over 490 km of shoreline in the open Subareas 6-3, 6-5, 6-6, 6-7, 6-27 and 6-28 (Gil and Gribbell Island area). The lower 90% confidence limit of the mean density estimate for all Subareas combined was 17.8 sea cucumbers per metre of shoreline. By applying the density calculated from the survey to these surveyed areas, the combined TAC for the coast will be increased by 71.3 tonnes (26%) from the 1998 level. The 1999 coast-wide commercial TAC was

347.0 tonnes (765,000 lb.) split weight.

In May 2000, the PSCHA completed approximately 180 transects over 354 km of shoreline in the open Subareas 12-40 and 12-41. The lower 90 percent confidence limit of the mean density estimate for Subarea 12-40 and 12-41 was 6.43 and 5.08 sea cucumbers per metre of shoreline, respectively. By applying the density calculated from the survey to these surveyed areas, the combined TAC for the coast will be increased by 19.3 tonnes (5.5 percent) from the 1999 level. The 2000 coast-wide commercial TAC was 370.1 tonnes (816,000 lb.) split weight.

3.3.3.3. Research

The Department is working in collaboration with the PSCHA and First Nations to determine means of examining and measuring abundance, growth, recruitment, settlement, and mortality in sea cucumber populations.

First Nations throughout the coast, including the Kitasoo Fisheries Program, Haisla, Tsimshian and Heiltsuk First Nations, and the Council of the Haida Nation have been working toward assessing stocks in local fishing areas. In particular, several years of data have been collected on sea cucumber biology and population status in the Central Coast region of BC (Ken Cripps, personal communication). In 1993, the Department and the Kitasoo Fisheries Program developed a survey methodology for sea cucumbers, based on the protocol used in Alaska, and conducted multiple transect surveys to determine optimal sampling frequency. Annual surveys continue to date, and several reports are in preparation on both the transect survey results and the biological data collected concurrently with the surveys. Some of this information has been used and built upon by Fisheries and Oceans Canada in setting up similar experimental and research sites throughout B.C.

In the fall of 1997, under the adaptive management plan, the PSCHA, First Nations, and Fisheries and Oceans Canada began to conduct transect surveys to obtain biomass and distribution information for the selected sea cucumber populations. These surveys are conducted in the 25% of the coastline reserved for research purposes. Based on the results of these abundance surveys, experimental fishing areas (EFAs) are designed to examine the response of sea cucumber populations to various levels of exploitation. The experimental approach to investigating the productivity of populations is being pursued in the absence of information on age, growth and mortality. This information will ultimately be used to develop a biologically based management plan.

Experimental fishing areas each include five sites measuring 10-km shoreline length. The sites are fished at harvest rates of 16 percent, eight percent, four percent, two percent and zero percent (control), thus bracketing the assumed-conservative rate of 4.2 percent. These sites will be harvested annually and surveyed every two to four years until a measurable impact is noticed (likely in the 16 percent and eight percent sites), at which time the individual site fishery will be terminated. In general, it is expected that experimental fisheries will continue for at least nine to 10 years (five years after first four year old recruits are seen).

To date, transect surveys have been conducted in the southern Strait of Georgia, the Jervis Inlet area, and two areas in the Central Coast region of British Columbia. Experimental harvesting projects are underway in Jervis Inlet, Tolmie Channel and Laredo Inlet (Hand and Rogers 1999). A fourth area on the West Coast of Vancouver Island (portions of Subareas 25-8 and 25-9) was surveyed during the summer of 1999.

3.3.3.4. Prospects for the fishery

The sea cucumber fishery is managed conservatively through an adaptive management regime that will continue for at least 10 years. A precautionary approach to management, which ensures the Department is meeting its conservation and sustainability goals, will continue for the foreseeable future. The Department will develop a biologically-based management regime through a collaborative process with the commercial industry, Aboriginal organizations and other stakeholders.

Population biomass and density surveys have consistently shown that densities are higher than our conservative assumption of 2.5 sea cucumbers per metre of shoreline. Barring poor weather conditions, it is anticipated that individual quotas will be easily attained in each fishing season.

3.3.4. Current Management Issues

3.3.4.1. Recent

- Fishers would like the opportunity to stack more than three licences on one vessel at a time. Action to date: The pilot IQ program established in 1995 for sea cucumbers, red sea urchins and green sea urchins restricts the number of stacked licences to three per vessel. Evaluation of, and potential changes in, the pilot IQ programs will follow a review of Pacific Region licensing and management policies.

- Hail notification infractions created difficulties both in anticipating individual boat quotas when a quota area was near completion and in appropriate notification for the dockside observers. Action to date: Notification procedures (prior to fishing and after completing fishing) in the 2000 management plan explained why the notification is required and how the information is used. In addition, on-grounds communication through voluntary industry representatives facilitated the transmission of information.

- Licence holders need ample time to buy licences, obtain logbooks and travel to the fishing grounds prior to the start of the fishing season. Action to date: Under the IFMP protocol, the 1999 and 2000 management plans were finalized 4 weeks prior to the fishery and licensing began slightly earlier than in previous years. Continue to make licences available two to three weeks prior to the opening time to allow for preparation time for buyers, fishers and the service bureau.

- It is often difficult to confirm and verify designated licences prior to issuance of validation logs. Action to date: The service bureau will be informed regularly, or upon request, of the status of licence designations.

- The gradual increase in IQ may require a review of the length of the fishing season in order to allow sufficient time to achieve quotas. Action to date: Consider a four-week fishery for 2000. PSCHA provided advice prior to management plan completion - the fishing season remains three weeks long at this time.

- The requirements for the submission of harvest charts are difficult to follow for this fishery as divers move often and quickly. Large numbers of charts must be supplied to each vessel at the beginning of the season to ensure that all licence holders have access to the few charts that they need. Action to date: Explore other options to improve the distribution and collection of harvest charts in a timely manner.

- Catch reporting structures for the First Nation fisheries are limited. Action to date: The Department is consulting with First Nations throughout coastal British Columbia on a more comprehensive approach to gathering catch data by negotiating agreed upon protocols outlined in the Fisheries Agreements and/or Communal Licences.

- First Nations have concerns related to their commercial fishing opportunities and current and future access to sea cucumber for food, social and ceremonial purposes. Action to date: Continue consultation with Aboriginal organizations to ensure that access is appropriate.
- The Department has a minimal amount of biological data with which to assess the fishery and from which to develop management plans. Action to date: Continue collaborative research programs with commercial industry, First Nations and other stakeholders.
- Incorrect reporting of commercial harvest information is attributed to lack of diver knowledge of Area boundaries. Action to date: Maps of quota management areas included in 1999 IFMP were updated for 2000.
- The Validation & Harvest logbooks and harvest charts show a concentration of effort into some fishing locations. This has created some concern for the effects of localized over fishing. Action to date: Annual improvements to quota area management, to fine-tune boundaries and break up the concentration of effort in areas of concern.

3.3.5. Specific Management Objectives

3.3.5.1. Conservation/Sustainability

Stock Assessment and Fisheries Management aim to:

- Collect fishery data in a way that will test current assumptions of population abundance and productivity.
- Harvest static areas to enable the collection of a time series of fishery-dependent information, which can be examined to determine harvest impacts within these areas.
- Develop research and fishing protocols that will enable the Department and industry to acquire the needed information for the wild fishery and potential aquaculture initiatives.
- Collaborate with the commercial industry and First Nations to conduct abundance surveys and test harvest rates.

3.3.5.2. International Considerations and Obligations

Information to Transport, Import and Land Shellfish in Canada

Pursuant to the *Coastal Fisheries Protection Act*, foreign fishing vessels can only enter Canadian waters and offload fish where a licence is issued under *the Coastal Fisheries Protection Regulations* or such activities are authorized by a treaty. In the case of U.S. vessels, there is a treaty in place for roe herring, salmon, tuna, halibut and sablefish. However, only vessels from flag states listed in section 5(1)(a) of the *Coastal Fisheries Protection Regulations* are eligible to be issued licences to land fish in Canada. As the U.S. is not on this list, U.S. vessels are not eligible to receive licences to land other species (including shellfish) in Canadian ports.

Masters of Canadian fishing vessels receiving shellfish, i.e. trans-shipping shellfish, from a U.S. fishing vessel, in waters other than Canadian fisheries waters, require four licences:

- Licence to trans-ship fish in waters other than Canadian Fisheries Waters.
- Licence authorizing the vessel master of a Canadian Fishing Vessel to bring fish received from a U.S. Fishing Vessel into Canadian Fisheries Waters and land the fish at a Canadian port.
- Licence to transport fish in Canadian Fisheries Waters.
- Licence to import fish into Canada.
- Contact the Pacific Fishery Licensing Unit in Vancouver (Tel: [604] 666-0566, Fax: [604] 666-5855) for further information.

3.3.5.3. Domestic Considerations

Aboriginal Fishery:

Fisheries and Oceans Canada provides opportunities for First Nation access to the fishery for food, social and ceremonial purposes. The Department will continue to provide opportunities for First Nations to harvest fish for food, social and ceremonial purposes, in a manner consistent with the *Sparrow* decision (see the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/AFS/Default.htm

Under the pilot IQ program, two percent of the estimated coastwide TAC is reserved for First Nations food, social and ceremonial purposes. Additional allocation for sea cucumbers will be considered for First Nations who demonstrate they are unable to meet the food, social and ceremonial needs of their members.

Recreational Fishery:

The Department will continue to provide opportunities for a recreational fishery for sea cucumbers.

Commercial Fishery:

The Department will continue to work collaboratively with the PSCHA and other stakeholders to improve the biological database and thus improve the assessment of the fishery resource.

The pilot IQ program established in 1995 for sea cucumbers, red sea urchins and green sea urchins restricts the number of stacked licences to three per vessel. Fishery managers will continue to investigate the possibility for change to this program. No changes were implemented for the 2000 fishing season.

The service bureau will be informed regularly, or upon request, of the status of licence designations.

Options to improve the distribution and collection of harvest charts, in a timely manner, will be explored.

On-grounds communication will be established to aid hail notification and the proper completion of area quotas.

3.3.6. Management Measures

3.3.6.1. Fishing Seasons

In 2000, the commercial fishery was scheduled to occur over a three week period from October 2 to 23. The 2001 commercial fishery will occur over a similar timeframe.

First Nations and recreational fisheries are open year-round in all areas, or as detailed in the British Columbia Tidal Waters Sport Fishing Guide for the recreational fishery.

3.3.6.2. Control and Monitoring of Fishing Activities

Catch Validation Agreement

A collaborative agreement between the Department and the PSCHA is consistent with the Department's approach to co-management in the Region. This agreement provides catch validation at designated landing ports, in-season collection and compilation of harvest log data, collection of biological samples and a year-end summary report of the fishery. The program is industry funded.

Fishing Notification and Dockside Validation

In 1995, when the IQ management regime was implemented, a service bureau was contracted by the PSCHA to validate catch. Fishers are required to report to the service bureau prior to fishing, following fishing, and prior to landing sea cucumbers. All catch must be weighed and validated at the first point of landing by a Fisheries and Oceans Canada certified observer.

Licence Area Selection

The coast is divided into four harvest areas, one of which each licence is designated to prior to the fishing season. Harvest area designation is accomplished through voluntary area selection and, when required, a lottery conducted by Fisheries and Oceans Canada Pacific Fishery Licence Unit. The PSCHA is responsible for ensuring that the area selection process is completed prior to the fishery opening.

First Nations and recreational fisheries

Catch monitoring and reporting requirements are outlined in the First Nations fisheries agreement and/or Communal Licence. There are currently no reporting requirements for the recreational harvest of shellfish.

Catch monitoring programs are being developed in collaboration with some Aboriginal organizations and the recreational fishing sector.

3.3.6.3. Quota Allocations

Surveys in 2000 in Subareas 12-40 and 12-41 resulted in a 5.5 percent increase in coast-wide TAC. The following table shows the most recent stock assessment figures used to calculate the commercial TAC for 2000 after two percent is removed for First Nations food, social and ceremonial purposes. See the document entitled Sea Cucumber Phase 1 Fishery Progress Report (Hand and Rogers 1999) for more detail.

Region		Calculated TAC (t)	Calculated TAC (lb.)	Two Percent Available for First Nations Use (lb.)	2000 Commercial TAC (lb.)
Prince Rupert District (PRD) Quota Management Areas					
5A	Porcher Is./Banks Is.	20.3	44,694	894	43,000
5B	Principe Ch./Grenville Ch.	24.1	53,078	1,062	50,200
6A	Gil Is.	44.2	97,431	1,949	95,000
6B	Gribbell Is.	53.1	117,103	2,342	114,000
6C	Caamano Snd./Laredo Ch.	24.5	54,099	1,082	53,000
PRD Total		**166.2**	**366,405**	**7,328**	**355,200**
Central Coast District (CCD) Quota Management Areas					
7A	Seaforth Ch./Spiller Ch.	22.1	48,666	973	44,125
7B	Milbanke Snd.	31.3	68,954	1,379	67,510
7C	Denny Is.	44.5	98,094	1,962	94,878
8A	Queens Snd./Fitz Hugh Snd.	37.3	82,287	1,646	81,487
CCD Total		**135.2**	**298,001**	**5,960**	**288,000**
East Coast Vancouver Island (ECVI) Quota Management Areas					
12A	N. QC. Strait	12.9	28,419	568	27,500
12B	S. QC Strait	32.8	72,309	1,446	70,400
13A	Quadra/Cortes	9.1	20,158	403	19,500
13B	N. Area 13	8.1	17,756	355	17,000
ECVI Total		**62.9**	**138,642**	**2,773**	**134,400**
West Coast Vancouver Island Quota Management Areas					
24A	N. Clayoquot	8.1	17,841	357	18,200
24B	S. Clayoquot	9.2	20,232	405	20,200
WCVI Total		**17.3**	**38,072.80**	**761.5**	**38,400**
Coastwide TAC		**381.5**	**841,120**	**16,822**	**816,000**
Individual Quota					9,600

The coastwide TAC for 2000 was 370.1 t (816,000 lb.) split weight and was apportioned accordingly to the following licence areas:

Licence area:	TAC (t):	TAC (lb.):	# Licences:
West Coast Vancouver Island	17.4 t	38,400	4
East Coast Vancouver Island	61.0 t	134,400	14
Central Coast District	130.6 t	288,000	30
Prince Rupert District	161.1 t	355,200	37

Individual quotas equalled 1/85 of the coastwide TAC, or 4.4 t (9,600 lb.) split weight per licence.

Historical

The IQ program for the sea cucumber fishery was implemented in September 1995 and the annual commercial TAC was set at 637 tonnes whole weight (233 tonnes split weight) for 1995 through 1997.

In 1996, the coastwide commercial TAC was 233.2 t (514,165 lb.) and IQs equalled 1/85 of the commercial TAC, or 2.7 t (6,049 lb.) split weight. The South Coast quota 54.9 kg (120,980 lb.) and the North Coast quota was 178.3 t (393,185 lb.) split weight.

In 1997, under the adaptive management plan, open Subareas were redistributed and quota allocated accordingly. The coastwide commercial TAC was 233.2 t (514,165 lb.) and IQ's equalled 2.7 t (6,049 lb.) split weight. The quota for the South Coast increased slightly to 57.6 t (127,029 lb.) split weight and the North Coast quota decreased slightly to 175.7 t (387,136 lb.) split weight. Overall, the baseline coastwide commercial TAC of 233 t has not changed since 1995.

Section 3.4.2 details the method by which the industry can increase the quota in open areas.

Following density surveys undertaken by the PSCHA and Heiltsuk Fisheries Program in Subareas 7-15, 7-17 and 7-30, the coastwide commercial TAC for the 1998 sea cucumber fishery was set at 275.7 t (607,750 lb.) split weight. Individual quotas equalled 1/85 of the coastwide commercial TAC, or 3.2 t (7,150 lb.) split weight per licence. A number of licences were designated to each area according to the area commercial TAC. Five licences were assigned to the West Coast Vancouver Island (Area 24), 13 licences to the East Coast Vancouver Island (Areas 12 and 13), 40 licences to the Central Coast District (Areas 7, 8 and 9) and 27 licences to the Prince Rupert District (Areas 4, 5 and 6). This reassignment of licences resulted in the move of three licences from South Coast areas to North Coast areas.

In 1999, the coastwide TAC was 347 T (765,000 lb.) as a result of surveys in Area 6. IQs were 4.1 t (9,000 lb.). Licences were split as follows: West Coast Vancouver Island, 4; East Coast Vancouver Island, 11; Central Coast, 32; and, Prince Rupert District, 38.

3.3.6.4. Licensing

Commercial:

Sea cucumbers are harvested commercially under the authority of a commercial licence (ZD) or a communal commercial licence (FZD). All licences are held by an individual party who must designate a harvest vessel each year. A maximum of three licences may be designated to any one vessel. The designated vessel must be eligible for a commercial vessel based licence of any of the following categories: A, C, F, G, K, L, N, R, S, T, and W.

Commercial (ZD) licences are "transferable" in that a licence holder may nominate a new party as the holder of the licence eligibility. Communal commercial (FZD) licences are allocated annually to First Nations groups, who may designate the licence to a vessel which meets the same criteria as the general commercial fishery licences.

Commercial sea cucumber licence fees for the 2000 season were $100.

Vessel length restrictions for vessels used to harvest sea cucumbers under the IQ pilot have been waived by Fisheries and Oceans Canada such that "ZD" licences may be designated to a vessel of any length permitted to harvest Schedule II species. Fisheries and Oceans Canada reserves the right to reinstate vessel length restrictions at the lengths associated with each licence tab.

Designated vessels must have a vessel survey on record with the Pacific Fishery Licence Unit, dated subsequent to May 1989. Vessel redesignation will only be permitted if the licensed vessel is out of service.

Aboriginal:

First Nations access to fish for food, social and ceremonial purposes is managed through a Communal Licence which can permit the harvest of sea cucumbers. For additional information on Communal Licences, see Section 3.3.4 and the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/afs/commlic.htm

Recreational:

A B.C. Tidal Waters Sport Fishing Licence is required for the recreational harvest of all species of fish. The daily limit for the recreational harvest of sea cucumbers is 12, with a possession limit of 24.

Processing

Six vessels received P-licences (for processing) in the North Coast in 1990, of which two processed 61 t of sea cucumber. In 1991, 3 P-licences were issued and two vessels processed 41 t. From 1992 to 1998 no P-licences were issued and no processed product was landed.

"P" licences are issued under the Pacific Fishery (General) Regulations, and must comply with the Fish Inspection Regulations. As a result, effective June 1998, any processing beyond that permitted in Section 14 (FIR) must be done in a registered fish processing facility and in full compliance with a Quality Management Program (QMP). If product processed at sea is to be eligible for export (leaving B.C.), the vessel must be a registered fish processing facility, i.e. registered with the Canadian Food Inspection Agency (CFIA) and have an approved QMP. If the processed product is intended for sale within B.C., the vessel must meet B.C. Ministry of Fisheries and B.C. Health requirements, prior to the issuance of a "P" licence.

3.3.6.5. Key Legislation

- The Fisheries Act and the regulations made thereunder.
- Areas and Subareas, as described in the Pacific Fishery Management Area Regulations, are referenced in describing quota management areas. Other legislation referenced for this fishery includes the Fishery (General) Regulations (i.e. Conditions of Licence) and the Pacific Fishery Regulations, 1993 (i.e. open times and size limits).

- The British Columbia Sport Fishing Regulations (1996) and the Aboriginal Communal Fishing Licences Regulations.

3.3.6.6. Conservation Harvesting Techniques and Selective Fishing Requirements

The commercial harvest of sea cucumbers meets the Pacific Region's requirements for avoiding "known non-target species and stocks or, if encountered, to release them alive and unharmed." Since commercial divers are restricted to hand picking, there is no bycatch in this fishery.

3.3.7. Enforcement Measures

3.3.7.1. Overview

The Conservation and Protection (C&P) directorate within the Fisheries Management sector directs the enforcement policy and responsibilities of the Department. Fishery officers, marine enforcement officers, fishery guardians, and Aboriginal fishery guardians working throughout Pacific Region carry out enforcement activities. Observers, designated by the Department, complement enforcement staff by performing a monitoring, verification and sampling function.

There are approximately 170 fishery officers stationed in the Pacific Region, which encompasses the province of British Columbia and Yukon Territory. They are designated as "fishery officers" under section 5 of the *Fisheries Act* and have full enforcement powers and responsibilities outlined in the *Act*, The Criminal Code of Canada, and the *Constitution Act*. The fishery officer's uniform is khaki and green.

Marine enforcement officers also carry "fishery officer" designation and have the same powers and responsibilities as fishery officers. They work from Canadian Coast Guard (CCG) vessels and are trained in enforcement duties. The marine enforcement officer's uniform is blue and black.

Charter patrolmen hold the "fishery guardian" designation. Fishery guardians have more limited enforcement powers than a fishery officer does. Primarily they carry out observe, record and report activities and they have the authority to inspect, lay charges, and make seizures. They do not have the powers of search or arrest. The charter patrolmen's uniform consists of a blue shirt and grey slacks, and a blue hat with the charter patrol crest.

Some First Nation organizations employ Aboriginal Fishery Officers/Guardians to monitor the Aboriginal food, social and ceremonial fisheries of their organization. The Aboriginal Fishery Officers/Guardians carry a "Fishery Guardian" designation, depending on their level of training and carry out activities including stock assessment and catch monitoring, joint and co-ordinated patrols, reporting activities harmful to fish habitat, and consult and work co-operatively with DFO. Monitoring and Enforcement Protocols are negotiated between DFO C&P staff and some First Nation communities and are outlined in their Fisheries Agreements. The Aboriginal Guardian Program is currently under review by DFO.

Observers, designated by the Department, perform duties related to monitoring of fishing activities, examination and measurement of fishing gear, recording scientific data, monitoring the landing of fish and verification of the weight and species of fish caught and retained, and biological sampling. Observers are not armed and do not have the powers of search, seizure, or arrest.

The sea cucumber fishery has undergone significant changes over the past three years. With the introduction of IQs in 1995 and the associated dockside program to monitor and validate landings, the number of complaints relating to the sea cucumber fishery requiring enforcement intervention have been drastically reduced. The implementation of IQs has resulted in only three recorded occurrences in 1998/99 based on a records search of the Departmental Violation System (DVS), and only one violation which was related to a licensing issue. Officers in the Pacific Region spent a total of 18.5 hours on sea cucumber enforcement issues as reported in the Fishery Officer Reporting System (FORS). IQs reduced the incentive for fishers to pre-fish and stockpile product prior to an opening which had been one of the major enforcement problems prior to the implementation of IQs.

This fishery is considered a low priority. C&P staff will pursue opportunities to monitor and enforce the issues/problems associated with this fishery in conjunction with the monitoring and enforcement activities associated with the identified priority fisheries in the Pacific Region.

3.3.7.2. Main Program Activities

In order to address the priority issues of catch validation, licensing and the harvest of prohibited species identified by Fisheries Management staff, fishery officers will pursue opportunities to monitor and inspect fishing vessels at sea and periodically conduct landing verifications.

Since the introduction of IQs and a stable TAC in 1996, enforcement effort has focussed on ensuring compliance with registration and fishers' licence requirements, logbook completion, and closed time/area patrols. There is no size limit and because divers individually harvest the cucumbers, by-catch is not an issue. However, as with other dive fisheries, the incentive to harvest illegal but lucrative species (e.g. abalone) remains an issue.

Inspections of vessels participating in this fishery will focus on the priority issues with respect to hails, landing records, and harvest log requirements. Closed time/area patrols may be conducted by CCG patrol vessels, program vessels, or by air in conjunction with priority fishery patrols. Investigations may also occur on an opportunistic basis with notification from Fisheries Management that a violation has occurred.

3.3.7.3. Fishery Patrol Vessels

All at sea patrols will be conducted using program vessels (mostly 7.3 meter and 9.2 meter rigid hull inflatable vessels) and CCG vessels. They are staffed and operated by fishery officers, native guardians, and marine enforcement officers. At sea patrols will be conducted on a planned and ad hoc priority basis. CCG patrol vessels as well as C&P program vessels, in conjunction with fishery officers and marine enforcement officers, will conduct boardings in the harvest areas.

Patrols will be conducted in both open and closed areas as priorities allow.

3.3.7.4. Air Surveillance

Patrol coverage using aircraft is not anticipated at this time. There may be limited opportunity to utilise the regional air surveillance plane to patrol closed areas/time and locations of fishing vessels, if priorities allow and the contract is renewed.

3.3.7.5. Enforcement Issues and Strategies

In the following table:

PFR: *Pacific Fisheries Regulations, 1993*

F[G]R: *Fisheries (General) Regulations*

S: Section

Issues	Sections	Strategy
Licensing verification Vessel licensed? No fishers registration card (FRC). Fail to produce FRC.	PFR (S)22 PFR (S)25 F(G)R (S)11	At-sea and dockside inspections will occur when opportunities exist. These inspections may include checks of all licensing documents on board the vessel to ensure compliance with the Regulations.
Fish during close time/area.	PFR (S)63	Patrols utilizing patrol vessels will be pursued when opportunities exist. Possibilities may exist to use the Regional Enforcement Charter Aircraft in co-ordination with other scheduled patrols of priority fisheries.
Fail to maintain Harvest logbook and Chart Data.	F(G)R (S)22(7)	At-sea dockside inspections will occur when opportunities exist. Investigation will occur on an opportunistic basis after C&P has been notified that a violation has occurred. The investigation will be pursued as priorities permit.
Use suction device for harvesting sea cucumbers. Fail to land sea cucumbers at a designated landing port. Fail to validate all sea cucumbers harvested. Failure of all divers to have a Worker's Compensation Board Seafood Harvesting Diving Certificate.	F(G)R (S)22(7)	At-sea dockside inspections will occur when opportunities exist. Investigation will occur on an opportunistic basis after C&P has been notified that a violation has occurred. The investigation will be pursued as priorities permit.
Fail to provide proper landing and hail information, lack of notification for change of area, cancellation of trip, or incorrect reporting of area fished.	F(G)R (S)22(7)	At-sea dockside inspections will occur when opportunities exist. Investigation will occur on an opportunistic basis after C & P has been notified that a violation has occurred. The investigation will be pursued as priorities permit. Aircraft or vessels may be used on an opportunistic basis to track vessels in the fishery.

3.3.8. Financial Responsibilities

3.3.8.1. Industry and/or other Harvesters

The Department holds a collaborative agreement with the PSCHA for catch validation and biological sampling. The PSCHA funds research and management programs through fees to association members. This includes stock assessment surveys, biological research surveys, a catch validation program and a biologist hired to co-ordinate research with the department. Association fees in 2000 were $1,000 per licence and total PSCHA contributions toward management and assessment programs were approximately $85,000.

3.3.8.2. Fisheries and Oceans Canada

One Stock Assessment and three Resource Management personnel are directly involved in this fishery. Contributions to the IFMP are provided by the Fisheries Management Directorate, the Science Branch, the Shellfish Data Unit, the Conservation and Protection Directorate, the Pacific Fishery Licence Unit, the Aboriginal Fisheries Strategy, the Recreational Fisheries Division, the Oceans Directorate and numerous administrative personnel. Generally, all personnel are multi-tasked, i.e. Fishery Managers work on all dive fisheries. Therefore, costs incurred by the Department to manage this fishery are difficult to assess.

3.3.9. Performance Review

3.3.9.1. Management Plan Evaluation Criteria for 2000

- Assess the value of using "on-grounds co-ordinators" for the transmission of quota and area closure information. See 2001 IFMP.
- Assess the length of fishing season. Is three weeks long enough, considering the increase in IQ? See 2001 IFMP.
- Assess the modifications made to the harvest chart provision and submission process. See 2001 IFMP.
- Assess redesign of Quota Management Areas in the North Coast. Did the reassignment of areas succeed in redistributing effort?

3.3.9.2. Conservation and Protection Plan Evaluation Criteria

Not applicable at this time.

3.3.9.3. Annual (Post-Season) Review Results for 1999

Overall, the 1999 fishing season was successful. 85 licences were fished on 39 vessels. Weather hampered fishing in many areas and, in combination with an increase in IQ, resulted in a request for an extension to the fishery opening. All individual quotas were achieved by fishery closure on November 1. In general, compliance with the catch validation program was good. In-season issues are noted in Section 6.

A review of 1999 Management Plan Evaluation Criteria and results follows:

Assess availability of resource for First Nations food, social and ceremonial purposes. Maintain lines of communication and continue consultation.

Annual and in-season consultation on assessment and management programs continues. Fishery managers met with members of the Kwakiutl First Nation to discuss access to sea cucumbers in Beaver Harbour (Subarea 12-16), after concerns were raised over the location of some fishing effort during the 1999 season. Commercial effort was voluntarily directed away from the harbour for the remainder of the season to help facilitate future discussions regarding the management of the fishery in this area.

Continue with density surveys and experimental studies.

A density survey was completed in Area 12 in May 2000. Results are incorporated into the 2000 Commercial Harvest Plan. Experimental sites in Laredo, Tolmie and Jervis were resurveyed and maintained.

Assess value of maps of Quota Management Areas. Were they useful to fishers? Did accuracy of data improve?

Maps were generally believed to be useful, although the scale and size necessary for the management plan is not as useful as something more detailed is. The Sectoral committee recommends the continued use of the maps.

Assess redesign of Quota Management Areas in the North Coast. Did the reassignment of areas succeed in redistributing effort?

Some effort was redistributed into the new Quota Management Areas. No changes are recommended for 2000.

3.3.10. References Cited

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Appendix 3.3.1. Summary of sea cucumber landings (split tonnes), value and effort, 1980 to 2000, as reported on fish slips and Validation & Harvest logs (Note: CPUE data removed from this report).

Year	Licences Issued	Quota			Commercial Fishery Landings		Experimental Fishery Landings[8]	Landed Value	Effort		
		Round (t)[1]	Pieces(#)[2]	Split (t)	Round (t)	Split (t)[1]	Split (t)	($·10³)	Vessels w/landings	Fishing Days	Avg. Diver Day Length (hr)[3]
1980						7.3			9	59	ND
1981						9.9			11	ND	ND
1982						1.8			ND	ND	ND
1983						193.0			19	356	3.4
1984						41.4		22	12	249	3.6
1985	Z 40					126.7		94	21	271	2.9
1986	Z 63	1500	2,362,205	549.5	786	287.9		236	34	733	3.1
1987	Z 151	1500	2,362,205	549.5	1,722	630.8		768	56	1,906	4.5
1988	Z 160	1500	2,362,205	549.5	1,922	704.0		984	79	1,512	2.7
1989	Z 245	800	1,259,843	293.0	1,144	419.0		977	91	1,022	2.1
1990	Z 215	800	1,259,843	293.0	870	318.7		1,167	126	1,153	2.7
1991	Z 78	800	1,259,843	293.0	1,340	490.8		1,029	60	535	2.6
1992	Z 84			293.0		521.0		1,363	77	449	3.2
1993	Z 84			238.0		298.0		982	75	201	3.8
1994 [4, 5, 6]	Z 85			210.5		196.0		976	71	164	3.8
1995 [4, 7]	Z 85			233.3		217.3		956	47	308	3.4
1996	Z 85			233.3		240.7		688	50	142	3.1
1997	Z 85			233.3		229.9		780	41	146	3.7
1998	Z 85			275.7		276.2	11.2	986	41	178	n/a
1999	Z 85			347.0		347.8	26.7	1,140	39	233	n/a
2000	Z 85			370.1		371.9	26.9	1,748	34	226	n/a

[1] Quota, landings and CPUE for 1986 to 1991 were reported in round weight. Quota, landings and CPUE are all converted to split weight. Conversion factor of 2.73 (round to split weight) used.

[2] Number of pieces calculated from standardized wet weight per sea cucumber, 1.4 lb (0.635 kg).

[3] Data from harvest logs.

[4] Data incomplete.

[5] Quota was reduced by 27.5 t split weight due to overages in the 1992 Inside Waters fishery.

[6] A reported 20,255 lb were spoiled and dumped - it is not known if they are included in this landing record.

[7] Total # active vessels does not equal # vessels per area as several vessels harvested quotas in 2 fishing areas and have been counted twice.

[8] Experimental fishery landings data supplied by Sophie Campagna - these figures don't appear in the fish slip database.

Appendix 3.3.2. Summary of sea cucumber landings (split tonnes) and values, 1980 to 2000.

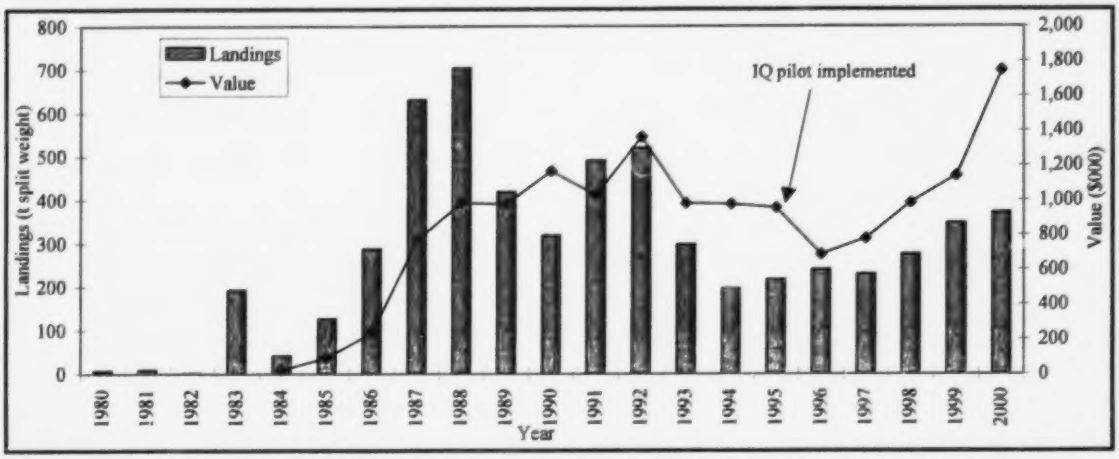

Figure 1. Summary of coastwide sea cucumber landings (split tonnes) and value, 1980 to 1999.

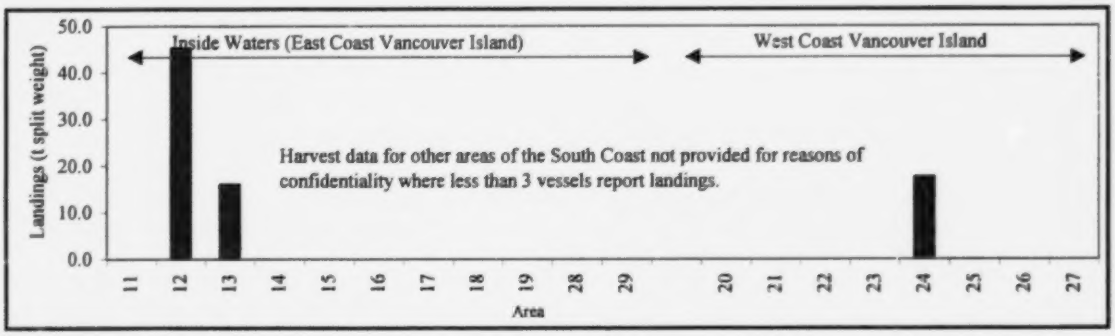

Figure 2. Summary of South Coast sea cucumber landings (split tonnes) in 2000, by Fishery Management Area.

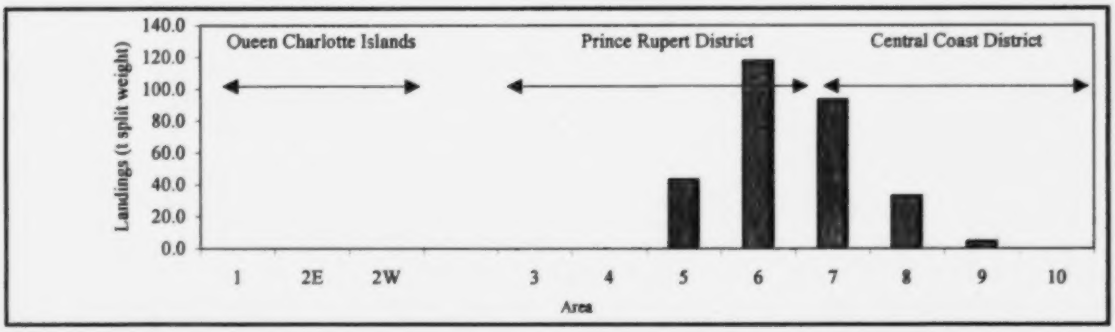

Figure 3. Summary of North Coast sea cucumber landings (split tonnes) in 2000, by Fishery Management Area.

Appendix 3.3.3. Summary of commercial fishery open areas, dates and quotas, 1986 to 2000.

Year	Portions of PFM Areas/Subareas	Quota[1] (t)	Pieces (#)	# Licences	Fishery open
Queen Charlotte Islands					
1986	1,2E,2W				
1987	1,2E,2W				
1988	1,2E,2W				
1989	1,2E,2W	59			
1990	1,2E,2W	59	252,000		Jan1 to Feb17
1991	1,2E,2W	59	252,000		Jan14 to Feb2
1992	1,2E,2W	59	245,833		Jan15 to 30
1993	1,2E,2W	59	245,833		Feb2 to 9
1994	ptn. 2E	59	245,833		Nov3 to 8
1995	2-3 to 2-10	57.7	-	21	Nov15 to Dec5
1996	closed	-	-	-	-
1997	closed	-	-	-	-
1998	closed	-	-	-	-
1999	closed	-	-	-	-
2000	closed	-	-	-	-
Prince Rupert District					
1986	3,4,5				
1987	3,4,5				
1988	3,4,5				
1989	3,4,5	62			
1990	3,4,5	62	267,750		Jan1 to 23
1991	3,4,5	62	267,750		Jan14 to 22
1992	3,4,5	62	258,333		Jan15 to 18
1993	3,4,5	62	258,333		Feb2 to 4
1994	3 and 4	62	258,333		Nov3 to 6
1995	3,4	60.5	-	22	Nov15 to Dec5
1996	5, 6	90.5	-	33	Oct7 to 21
1997	5, 6	87.8	-	32	Sep22 to Oct12
1998	4, 5, 6	87.6	-	27	Oct5 to 26
1999	4, 5, 6	155.1	-	38	Oct4 to Nov1
2000	4, 4, 6	161.1	-	37	Oct2 to 25
Central Coast District					
1986	6 to 10				
1987	6 to 10				
1988	6 to 10				
1989	6 to 10	62			
1990	6 to 10	62	267,750		Jan1 to 8
1991	6 to 10	62	267,750		Jan14 to 17
1992	6 to 10	62	258,333		Jan15 to 16
1993	6	62	258,333		Feb2 to 3
1994	7	62	258,333		Nov3 to 4
1995	7, 8	60.5	-	22	Nov15 to Dec5
1996	7	87.8	-	32	Oct7 to 21
1997	7, 8	87.8	-	32	Sep22 to Oct12
1998	7, 8, 9	129.7	-	40	Oct5 to 26
1999	7, 8, 9	130.6	-	32	Oct4 to Nov1
2000	7, 8, 9	130.6	-	30	Oct2 to 19

Year	Portions of PFM Areas/Subareas	Quota[1] (t)	Pieces (#)	# Licences	Fishery open
East Coast Vancouver Island (Inside Waters)					
1986	11 to 19, 28, 29	183			
1987	11 to 19, 28, 29	183			
1988	11 to 19, 28, 29	183			
1989	11 to 13, 18, 19	55			
1990	11 to 13, 18,19	55	236,250		Jan1 to 12
1991	18, 19, 20	55	236,250		Jan14 to 26
1992	12 and 13	55	229,167		Jan15 to 19
1993	18 and 19	27.5	114,583		Feb2 to 3
1994	closed	0	0		-
1995	12, 13-7 to 13-12, 13-24 to 13-43	27.4	-	10	Nov15 to Dec3
1996	18, 19	27.5	-	10	Oct7 to 21
1997	12, 13	41.2	-	15	Sep22 to Oct12
1998	12, 13	42.2	-	13	Oct5 to 26
1999	12, 13	44.9	-	11	Oct4 to 20
2000	12, 13	60.9	-	14	Oct2 to 25
West Coast Vancouver Island					
1986	20 to 27	183			
1987	20 to 27	183			
1988	20 to 27	183			
1989	20 to 27	55			
1990	20 to 27	55	236,250		Jan1 to 15
1991	25 to 27	55	236,250		Jan14 to 25
1992	23 and 24	55	229,167		Jan15 to 23
1993	26 and 27	27.5	114,583		Feb2 to 3
1994	23 and 24	27.5	114,583		Nov3
1995	25, 24-7	27.4	-	10	Nov15 to 28
1996	26, 27	27.5	-	10	Oct7 to 21
1997	24	16.5	-	6	Sep22 to Oct12
1998	24	16.2	-	5	Oct5 to 26
1999	24	16.3	-	4	Oct4 to 19
2000	24	17.4	-	4	Oct2 to 19

Appendix 3.3.4. Comparison of commercial sea cucumber fishery open areas, 1991 to 2000.

Area	Total Number of Subareas	Number of Subareas in management plan 1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1/101	19	7	7	7	0	0	0	0	0	0	0
2/102	94	88	88	88	7	8	0	0	0	0	0
3/103	20	18	18	18	18	18	0	0	0	0	0
4/104	23	16	16	16	16	16	0	0	1	1	1
5/105	28	22	22	22	0	0	5	11	19	19	19
6/106	32	28	28	28	0	0	3	10	16	16	16
NORTH COAST	**216**	**179**	**179**	**179**	**41**	**42**	**8**	**21**	**36**	**36**	**36**
7/107	37	28	28	0	9	3	7	18	22	22	22
8/108	20	16	16	0	0	2	0	9	9	9	9
9/109	14	12	12	0	0	0	0	0	3	3	3
10/110	14	12	12	0	0	0	0	0	0	0	0
130	4	0	0	0	0	0	0	0	0	0	0
142	3	0	0	0	0	0	0	0	0	0	0
CENTRAL COAST	**92**	**68**	**68**	**0**	**9**	**5**	**7**	**27**	**34**	**34**	**34**
11/111	12	0	0	0	0	0	0	0	0	0	0
12	49	0	48	0	0	42	0	10	10	10	10
13	44	0	43	0	0	26	0	10	10	10	10
14	16	0	0	0	0	0	0	0	0	0	0
15	7	0	0	0	0	0	0	0	0	0	0
16	23	0	0	0	0	0	0	0	0	0	0
17	22	0	0	0	0	0	0	0	0	0	0
18	12	11	0	11	0	0	9	0	0	0	0
19	13	12	0	12	0	0	4	0	0	0	0
28	15	0	0	0	0	0	0	0	0	0	0
29	18	0	0	0	0	0	0	0	0	0	0
ECVI	**231**	**23**	**91**	**23**	**0**	**68**	**13**	**20**	**20**	**20**	**20**
20	8	7	0	0	0	0	0	0	0	0	0
21/121	5	0	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	0	0	0	0	0	0
23/123	22	0	11	0	11	0	0	0	0	0	0
24/124	20	0	9	0	6	1	0	8	8	8	8
25/125	24	16	0	0	0	16	0	0	0	0	0
26/126	17	11	0	11	0	0	9	0	0	0	0
27/127	17	11	0	11	0	0	3	0	0	0	0
WCVI	**114**	**45**	**20**	**22**	**17**	**17**	**12**	**8**	**8**	**8**	**8**
COASTWIDE	**653**	**315**	**358**	**224**	**67**	**132**	**40**	**76**	**98**	**98**	**98**

Appendix 3.3.5. Summary of sea cucumber split weight landings (tonnes) by North Coast Management Area, 1980 to 2000, as reported on fish slips and Validation & Harvest logs.

NORTH COAST MANAGEMENT AREAS

	QCI			NC Mainland							Annual Totals[2]	
Year	1	2E	2W	3	4	5	6	7	8	9	10	split	round
1987		7			1	2	2	138	5			155	423
1988		<0.1			7	<0.1	44	155	6			212	579
1989		43			27	53	26	63	3			215	587
1990		27	1	20	16	21	12	70				167	456
1991		71		14	22	82	25	106				319	870
1992		66	2	18		68	51	37	17			259	707
1993	0	67	0	0	6	75	79	*	*	*	*	227	620
1994[1]	*	49	0	48	8	*	*	66	*	*	*	171	467
1995[3]	*	53.3	0.0	13.1	45.6	*	*	0.0	54.6	*	*	167	455
1996[3]	*	*	*	*	*	43.5	47.4	95.1	*	*	*	186	508
1997	*	*	*	*	*	31.7	53.0	29.3	58.0	*	*	172	470
1998	*	*	*	*	0.0	41.0	46.4	76.6	45.0	**	*	209	571
1999	*	*	*	*	0.0	38.3	117.1	98.2	32.6	0.0	*	286	781
2000	*	*	*	*	0.0	43.4	117.8	93.4	33.2	4.8	*	293	799
Area Totals	0	383	3	113	132	499	620	1,027	254	5	0	3,037	8,291

* Area not open under the annual management plan.

** Data not provided for reasons of confidentiality where less than 3 vessels report landings.

[1] 1994 data incomplete.

[2] Landings through 1991 were reported in round weight. All figures have been converted to split weight by dividing round weight by 2.73.

[3] Preliminary data from validation Logs.

Appendix 3.3.6. Summary of sea cucumber split weight landings (tonnes) by South Management Area, 1980 to 2000, as reported on fish slips and Validation & Harvest logs.

SOUTH COAST MANAGEMENT AREAS

	East Coast Vancouver Island											West Coast Vancouver Island								Annual Totals[2]	
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	22	23	24	25	26	27	split	round
1980/81				3		<0.1	5	6	<0.1			2				<0.1	<0.1			16	44
1982									0											0	0
1983			88	2		16	5	7	56						<0.1	<0.1	2	17		193	527
1984			1	2			22	5	11											41	112
1985		9	53	9		5	5	16	18		1					10				126	344
1986			16	31	14	31	66	67	59			1			2			1		288	786
1987		49	86	8	28	65	1	25	33	18		<0.1			13	50	62	33	4	475	1,297
1988	22	26	52	<0.1	6	5	1	83	31	<0.1		4			4	163	29	23	42	491	1,340
1989		22	48	*	*	*	*	16	10	*	*	19			14	52	11	1	11	204	557
1990		50	20	*	*	<0.1*	2*	12	2	*	*	3				49	11		4	151	412
1991	*	*	*	*	*	*	*	57	16	*	*	0	*	*	*	*	49	0	49	171	467
1992[1]	*	94	51	*	*	*	*	*	*	*	*	*	*	*	3	38	*	*	*	185	505
1993	*	*	*	*	*	*	*	21	10	*	*	*	*	*	*	*	*	12	29	72	195
1994	*	*	*	*	*	*	*	*	*	*	*	*	*	*	14	12	*	*	*	26	70
1995[3]	*	14.5	12.7	*	*	*	*	*	*	*	*	*	*	*	*	23.5	0.0	*	*	51	138
1996[3]	*	*	*	*	*	*	*	21.2	6.1	*	*	*	*	*	*	*	*	13.7	13.7	55	149
1997	*	24.6	16.6	*	*	*	*	*	*	*	*	*	*	*	*	16.6	*	*	*	58	158
1998	*	26.0	16.3	*	*	*	*	*	*	*	*	*	*	*	*	**	*	*	*	42	115
1999	*	28.9	**	*	*	*	*	*	*	*	*	*	*	*	*	**	*	*	*	62	168
2000	*	45.4	16.1	*	*	*	*	*	*	*	*	*	*	*	*	**	*	*	*	62	168
Area Totals	22	389	476	55	48	122	105	336	252	18	1	29	0	0	49	414	164	100	153	2767	7553

* Area not open under the annual management plan.

** Data not provided for reasons of confidentiality where less than 3 vessels report landings.

[1] Corrected weights for Areas 12 and 13 from Heizer and Hobbs, PSARC Working Paper I94-21

[2] Landings through 1991 were reported in round weight. All figures have been converted to split weight by dividing round weight by 2.73.

[3] Preliminary data from validation Logs

Appendix 3.3.7. History of Sea Cucumber Fishery Management Actions, 1971 to date.

1971 (1971 to 1976) Notes: COASTWIDE: First reported commercial landings of sea cucumber.
NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: -
COASTWIDE: TAC (lb.): 0 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 0 WCVI: 0

1981 (pre 1982) Notes: COASTWIDE: Sea cucumbers fished under the authority of a 'C' licence.
NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: -
COASTWIDE: TAC (lb.): 0 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 0 WCVI: 0

1982 Notes: COASTWIDE: Due to conservation concerns, the fishery was not opened in many areas. Scientific permits, with mandatory logbooks, were issued in South Coast areas; only 5 t were landed.
NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: -
COASTWIDE: TAC (lb.): 0 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 0 WCVI: 0

1983 Notes: COASTWIDE: Z-licence introduced with logbook requirements; facilitated the monitoring of fishing activity and fishery potential.
NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: -
COASTWIDE: TAC (lb.): 0 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 0 WCVI: 0

1984 Notes: COASTWIDE: P-licences issued; permitted vessels to process their own catch at sea.
NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: -
COASTWIDE: TAC (lb.): 0 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 0 WCVI: 0

1985 Notes: COASTWIDE: Category "Z-D" licence introduced. In consultation with processing plants, a standard wet landed weight of 1.4 lb. (0.635 kg) per cucumber was established.
NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: -
COASTWIDE: TAC (lb.): 0 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 0 WCVI: 0

1986 Notes: COASTWIDE: Sloan and Harbo (PSARC 1987) considered that only a small proportion of the stock was being harvested. Monitoring showed that some sea cucumbers were left untouched in harvesting areas (Department surveys '81, '83 & '85). Recruitment was observed on spat collectors suspended in the water. Recommendations were as follows: arbitrary, precautionary quotas and fishery monitoring through logbooks; research on juvenile growth rates and potential nursery areas.
NORTH: In June of 1986, the North Coast opened with a 500 t (round weight) arbitrary, precautionary quota.

SOUTH: n/a
OTHER: n/a
FISHERY OPEN: -
COASTWIDE: TAC (lb.): 1,211,428 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 147,781 WCVI: 147,781

1987 Notes: COASTWIDE: Following PSARC review in 1986, the entire B.C. coast was opened with an arbitrary, precautionary quota of 1500 t. Area closures. Processing on board permitted. Harvest logs and sales slips.

NORTH: First year of recorded landings.

SOUTH: CPUE began to decline in the South Coast areas; fishers reported increased search time. A recommendation was made to consider rotating areas, as managed in Washington State.

OTHER: Two vessels were given experimental licences to trawl for sea cucumber, but the sizes landed were small and the recovery of muscle strips was low.

FISHERY OPEN: January 1 to May 31, September 1 to December 31
COASTWIDE: TAC (lb.): 1,211,428 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 0 Central Coast: 0
ECVI: 147,781 WCVI: 147,781

1988 Notes: COASTWIDE: Area closures. Processing on board permitted. Fishing notification, harvest logs and sales slips requirements. Weekly processor reports required.

NORTH: Three sub quotas were set for the North Coast, 160 t round for QCI and 170 t round for each of Prince Rupert and the Central

SOUTH: Following the 1988 review, and apparent decline in CPUE, the South Coast quotas were reduced to 150 t round weight Inside and 150 t round weight WCVI.

OTHER: n/a
FISHERY OPEN: January 1 to May 31, September 1 to December 31
COASTWIDE: TAC (lb.): 1,211,428 IQ (lb.): 0
LICENCE AREA TAC QCI: 0 Prince Rupert: 403,773 Central Coast: 0
ECVI: 403,773 WCVI: 403,773

1989 Notes: COASTWIDE: Area closures. Processing on board permitted. Fishing notification, harvest logs and sales slips requirements. Weekly processor reports required.

NORTH: TAC split into three quotas for Central, Prince Rupert and QCI
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: January 1 to May 31, September 1 to December 31
COASTWIDE: TAC (lb.): 645,948 IQ (lb.): 0
LICENCE AREA TAC QCI: 129,207 Prince Rupert: 137,283 Central Coast: 137,283
ECVI: 121,132 WCVI: 121,132

1990 Notes: COASTWIDE: Area closures. Processing on board permitted. Fishing notification, harvest logs and sales slips requirements. Weekly processor reports required.

NORTH: n/a
SOUTH: n/a
OTHER: Up to six P-licences processed product in the North.
FISHERY OPEN: January 1 to May 31, September 1 to December 31
COASTWIDE: TAC (lb.): 645,948 IQ (lb.): 0
LICENCE AREA TAC QCI: 129,207 Prince Rupert: 137,283 Central Coast: 137,283
ECVI: 121,132 WCVI: 121,132

1991 Notes: COASTWIDE: Area closures. Processing on board permitted. Fishing notification, harvest logs and sales slips requirements. Weekly processor reports required. Licence limitation (78 licences).

NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: January 14 to May 31, September 1 to December 31
COASTWIDE: TAC (lb.): 645,948 IQ (lb.): 0
LICENCE AREA TAC QCI: 129,207 Prince Rupert: 137,283 Central Coast: 137,283
ECVI: 121,132 WCVI: 121,132

1992 Notes: COASTWIDE: Area closures. Processing on board permitted. Fishing notification, harvest logs and sales slips requirements. Weekly processor reports required. 84 licences (after appeals). Quotas were expressed as split weight for the first time in order to conform to industry landing practices and to facilitate the monitoring of landings. A global conversion factor of 2.73 split weight to round weight was introduced based on plant sampling and the standardized plant weight of a round sea cucumber of 0.635 kg (1.4 lb.).

NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: January 14 to May 31, September 1 to December 31
COASTWIDE: TAC (lb.): 645,948 IQ (lb.): 0
LICENCE AREA TAC QCI: 130,071 Prince Rupert: 136,685 Central Coast: 136,685
ECVI: 121,033 WCVI: 121,033

1993 Notes: COASTWIDE: Area closures. Processing on board permitted. Fishing notification, harvest logs and sales slips requirements. Weekly processor reports required. 84 licences.

NORTH: Area 7 was closed in the north in an attempt to direct fishing away from a heavily harvested location.
SOUTH: A three year area rotation was introduced in the South Coast to allow for two years of "recovery". As a consequence, quotas were reduced in each of the south coast quota areas from 55 t (split) to 27.5 t.
OTHER: Sport fishing for sea cucumber was closed coastwide until a bag limit was set in the Sportfish Regulations.
FISHERY OPEN: February 2 to December 31 (SC open 2d/wk until quota achieved)
COASTWIDE: TAC (lb.): 524,695 IQ (lb.): 0
LICENCE AREA TAC QCI: 130,071 Prince Rupert: 136,685 Central Coast: 136,685
ECVI: 60,627 WCVI: 60,627

1994 Notes: COASTWIDE: Area closures. Processing on board permitted. Fishing notification, harvest logs and sales slips requirements. Weekly processor reports required. Area licensing – annual selection 85 licences.

NORTH: n/a
SOUTH: There was no fishery in Inside Waters due to quota overages in 1992 in Areas 12 and 13.
OTHER: Export requirements.
FISHERY OPEN: NC: October 19 to November 2, SC: November 3 to November 15 (or until quota achieved)
COASTWIDE: TAC (lb.): 464,068 IQ (lb.): 0
LICENCE AREA TAC QCI: 130,071 Prince Rupert: 136,685 Central Coast: 136,685
ECVI: 0 WCVI: 60,627

1995 Notes: COASTWIDE: September 1995, pilot IQ program introduced. Equal IQs for each of the 85 licences. 2% First Nations allocation. IQ is1/85th of the quota of 233 t split weight or 6,049 lb./licence. Catch monitoring and validation program required. Service bureau contracted by Industry and all landings validated. Validation and Harvest logbooks combined. Area Closures. Processing on board permitted. Area licensing - annual selection. 85 licences. Licence stacking and transferability.

NORTH: 65 licences.
SOUTH: 20 licences.
OTHER: n/a
FISHERY OPEN: NC: November 15 to December 5; SC: November 15 to 28
COASTWIDE: TAC (lb.): 514,165 IQ (lb.): 6,049
LICENCE AREA TAC QCI: 126,985 Prince Rupert: 133,158 Central Coast: 133,158
ECVI: 60,406 WCVI: 60,406

1996 Notes: COASTWIDE: Area licensing – annual selection. 85 licences. Licence stacking and transferability. Area closures. Processing on board permitted. IQ is 1/85th of the quota of 233 t split weight or 6,049 lb./licence. Catch monitoring and validation required. Detailed harvest information and harvest maps required. Licence stacking and transferability. Four licensing areas - WCVI, ECVI, PR and CC.

NORTH: The licences from QCI were redistributed into the Central Coast and Prince Rupert. This was done as a small fishery of 6,049 lb./licence is barely economically viable from QCI. Options to increase economic viability for QCI are being discussed; industry funded population density surveys may justify quota increases
SOUTH: 20 licences.
OTHER: Sportfishing bag limit set at 12 per person per day with a two day maximum possession, open year round.
FISHERY OPEN: October 7 to 20, QCI closed
COASTWIDE: TAC (lb.): 514,165 IQ (lb.): 6,049
LICENCE AREA TAC QCI: 0 Prince Rupert: 199,617 Central Coast: 193,568
ECVI: 60,490 WCVI: 60,490

1997 Notes: COASTWIDE: New Adaptive Management Strategy in place, outlined in PSARC Working Paper I96-12. Pilot IQ program continued. Area licensing. 85 licences. Licence stacking and transferability. Area closures. Processing on board permitted. Catch monitoring and validation required. Detailed harvest information and harvest maps required. Licence stacking and transferability. Four licensing areas- WCVI, ECVI, PR and CC.

NORTH: n/a
SOUTH: n/a

OTHER: n/a
FISHERY OPEN: September 22 to October 12
COASTWIDE: TAC (lb.): 514,165 IQ (lb.): 6,049
LICENCE AREA TAC QCI: 0 Prince Rupert: 193,568 Central Coast: 193,568
ECVI: 90,735 WCVI: 36,294

1998 Notes: COASTWIDE: Pilot IQ program continued. Area licensing. 85 licences. Licence stacking and transferability. Area closures. Processing on board not permitted. Catch monitoring and validation required. Detailed harvest information and harvest maps required. Licence stacking and transferability. Four licensing areas - WCVI, ECVI, PR and CC. Coastwide increase in TAC by 18% as a result of

NORTH: Additional areas in Central Coast opened to ensure that exploitation rate remains at 4.2% (i.e. sufficient subareas opened to make up the estimated TAC of 217.3 t for the North Coast).
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: October 5 to 26
COASTWIDE: TAC (lb.): 607,750 IQ (lb.): 7,150
LICENCE AREA TAC QCI: 0 Prince Rupert: 193,050 Central Coast: 286,000
ECVI: 92,950 WCVI: 35,750

1999 Notes: COASTWIDE: Pilot IQ program continued. Area licensing. 85 licences. Licence stacking and transferability. Area closures. Processing on board not permitted. Catch monitoring and validation required. Detailed harvest information and harvest maps required. Licence stacking and transferability. Four licensing areas - WCVI, ECVI, PR and CC. Coastwide increase in TAC by 26% as a result of

NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: October 4 to 25
COASTWIDE: TAC (lb.): 765,000 IQ (lb.): 9,000
LICENCE AREA TAC QCI: 0 Prince Rupert: 342,000 Central Coast: 288,000
ECVI: 99,000 WCVI: 36,000

2000 Notes: COASTWIDE: Pilot IQ program continued. Area licensing. 85 licences. Licence stacking and transferability. Area closures. Processing on board not permitted. Catch monitoring and validation required. Detailed harvest information and harvest maps required. Licence stacking and transferability. Four licensing areas - WCVI, ECVI, PR and CC. Coastwide increase in TAC by 5.5% as a result of

NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: October 2 to 23
COASTWIDE: TAC (lb.): 816,000 IQ (lb.): 9,600
LICENCE AREA TAC QCI: 0 Prince Rupert: 355,200 Central Coast: 288,000
ECVI: 134,400 WCVI: 38,400

2001 Notes: COASTWIDE: Pilot IQ program continued. Area licensing. 85 licences. Licence stacking and transferability. Area closures. Processing on board not permitted. Catch monitoring and validation required. Detailed harvest information and harvest maps required. Licence stacking and transferability. Four licensing areas - WCVI, ECVI, PR and CC. Coastwide increase in TAC by 4% as a result of

NORTH: n/a
SOUTH: n/a
OTHER: n/a
FISHERY OPEN: October 1 to 22
COASTWIDE: TAC (lb.): 850,000 IQ (lb.): 10,000
LICENCE AREA TAC QCI: 0 Prince Rupert: 380,000 Central Coast: 290,000
ECVI: 130,000 WCVI: 50,000

4.0. CRUSTACEANS

4.1. Crab Trap Fishery – I. Winther

4.1.1. Introduction

This document reviews the fisheries for crab in British Columbia. It will deal primarily with Dungeness crab (*Cancer magister*) but will also consider the other commercially licensed species (*Cancer productus, Cancer gracilis, Paralithodes camtschatica,* and *Lithodes aequispina)* and other species caught under sport licences like box crab (*Lopholithodes mandtii* and *L. foraminatus*) and shore crabs (reptant decapod crustacea not mentioned above). The commercial fisheries for tanner crab and box crab that are currently being developed will not reviewed here.

Although the crab fishery has a commercial fishing history that spans over a century and a history of First Nation's use that precedes European contact in British Columbia, this document will deal primarily with events in the last two decades.

4.1.2. Biological Synopsis

Dungeness crabs occupy the eastern Pacific Ocean and range from the Aleutian Islands to Mexico, from the intertidal zone to depths of 180 m (Hart 1982). They are dioecious (separate sexes) and mature after 2 to 3 years. Mating occurs in the late spring and summer. Females brood eggs over the winter and spawning generally occurs in the early spring. Dungeness crabs live as planktonic larvae for approximately 3 months before settling to the ocean floor. Crabs have a hard exoskeleton that must be shed or moulted in order to grow. Male and female Dungeness crab grow at different rates. The males grow larger and usually reach the legal size of 165 mm carapace width at 4 or 5 years. Although the crab fishery is intense and crab resources are considered fully utilised the resource is not considered threatened in any way.

4.1.3. Overview of the Fishery

Dungeness crabs (*Cancer magister*) are the most important species of crab harvested in British Columbia and are exploited by commercial, aboriginal and sport fishers coast wide. The inception of the commercial fishery occurred before the turn of the century with first recorded landings in 1885 (Butler 1984). Recent (1980 to 2000) commercial landings and effort are presented in Tables 1 to 5. The sport fishery has an equally long history. Aboriginal harvests of Dungeness crab precede the discovery of North America by Europeans. First Nations fishers claim crab harvests for food as part of their heritage and are guaranteed access to the resource in Canada's constitution.

Crabs are most commonly harvested using traps or ring nets. They are occasionally collected from shallow waters by hand, using SCUBA, or dip nets. Sport and Native fishers may use any of these methods. Commercial fishers generally use traps or ring nets. Traps are frames covered with web to form an enclosure. Crabs gain access to the enclosure through a tunnel or door. The doors or tunnels may be triggered to form a one-way entrance. Ring nets are simply a circular frame holding a bag of web. Crab are captured in the web bag when they cross the edge of the frame and the frame is lifted. Traps and ring nets are baited with fish, squid, offal, or fish food pellets. Crabs enter the trap or ring net to feed on the bait or to investigate other crab activity. Ring nets are fished on single lines. Traps may be fished singly or on long lines with multiple traps.

4.1.3.1. Participants

There are currently 222 commercial crab fishing licences available for issue annually in British Columbia. Licences are vessel based and each licence is restricted to a particular vessel length. Vessels range from 3.9 m to 20.5 m in length. Crews are small and range from one to six people including the vessel master. Total crab fishing crews are estimated below 1000 people.

There are 33 coastal First Nations in British Columbia. Actual numbers of fishermen are unknown but are estimated at a few thousand people.

There are approximately 250,000 tidal water sport fishing licences issued annually. A small portion of anglers actually fish for crab. Recreational anglers that fish for crab are estimated at 10 to 20 thousand.

4.1.3.2. Location

The entire coast of British Columbia is open to some crab harvesting by First Nations and Recreational fishermen with the exception of some relatively small areas closed due to contamination by dioxins and furans. Commercial fisheries are further limited by area closures designed to provide access to crabs for First Nations and Recreational fisheries. The majority of the coast is open to all users, consequently, active fisheries are concentrated in areas of crab habitat. Dungeness crab are sand loving animals. They are commonly associated with sand or finer substrates like mud or silt. These areas are typically in river estuaries and off of sand beaches.

The two largest rivers in British Columbia are the Fraser River and the Skeena River. Both of these river estuaries support significant fisheries for Dungeness crab. The coast has numerous other smaller estuaries, which provide smaller individual opportunities for Dungeness crab populations and crab fisheries. When considered in aggregate these estuarine populations can compose larger fisheries such as in the Strait of Georgia.

The two largest areas of sand beach in British Columbia occur on the West Coast of Vancouver Island and on the north and east coasts of Graham Island in the Queen Charlotte Islands. The waters off of these sand beach areas also support significant Dungeness crab fisheries.

The red rock crab (*Cancer productus*) is more commonly associated with harder substrates like rock or gravel. This species is not a target of the commercial fishery although incidental catches are occasionally retained. Recreational and First Nation's fishermen also occasionally target red rock crabs, especially in areas where fishing for Dungeness is very competitive.

Northern British Columbia is the extreme southern edge of the range of Red king crabs (*Paralithodes camtschatica*). Commercial fisheries are small. Red king crab live in deep water, often below 300 meters, except when they move into shallow water (14 m) to mate in the spring. Recreational and First Nations' fishermen target red king crab at this time. Divers also collect them on rare occasions.

4.1.3.3. Time Frame

First Nation's and Recreational fisheries for Dungeness crab occur year round but typically effort is concentrated in the summer when weather allows small vessels to navigate local waters safely.

Commercial fisheries are managed around soft-shell closures where practical. Moulting typically occurs in the spring or the early summer. A six-week or longer, soft-shelled period follows moulting. The pattern of moulting can be difficult to determine if there are multiple components to the population. These components may represent separate year classes or subpopulations, perhaps from a separate estuary or other habitat. In these cases, moulting is protracted over a long period of time rather than a single event.

Weather patterns often dictate access to the crab fishery. Typically low-pressure systems from the Gulf of Alaska gyrate counter clockwise on to the coast bringing precipitation and south east winds of gale to hurricane force. In the winter the British Columbia coast receives 8 to 10 low-pressure systems per month. High-pressure systems may cause gale to storm force outflow winds near headlands and in the mainland inlets. High-pressure systems and outflow winds are often associated with extreme cold in winter, which may cause ice to stop fisheries in some northern inlets.

4.1.3.4. Landings/ Value/ Markets

Landings of Dungeness crab coast wide have declined since 1993 (Table 4.1.1.). Recent coast wide trends were driven by the Area A fishery which peaked in 1993 at 4798 tonnes (Table 4.1.2). Landings in Area B have declined since 1995. Effort has also declined significantly in Area B since 1995. Area B fishers report that crab abundance is down. Landings were above average on the West Coast of Vancouver Island in 1997 and 1998 and below average in 1999. Catches in Johnstone Strait, Strait of Georgia and Fraser River areas remain relatively stable.

The total value of the Dungeness crab fishery peaked in 1997 at $28M but has exceeded $20M since 1995. Prices have increased to an average of $7.49 kg^{-1} in 1999. Initial indications are that the price continues to increase in 2000 and could approach $10 kg^{-1}. The average annual value of Dungeness crab jumped to $7.44 kg^{-1} in response to poor fisheries in Washington and Oregon in 1997. Prices were near $8.80 kg^{-1} early in 1997 and in January 1998. The poor performance of the American fisheries in 1997 and 1998 was largely due to El Nino storms that kept the fleets from fishing for much of the season. However, market values have remained high after this influence subsided and the American fisheries returned to normal.

Crab fishing vessels were not allowed to change licensed fishing areas between 1997 and 1999. This was the first three year area selection. Fishers opted to maintain the 3-year term with new area changes allowed at the end of 1999. Area selections were completed January 15, 2000 for the period January 1, 2000 to December 31, 2002. Crab fishing vessels will not be allowed to change areas during this period. Area changes between 1999 and 2000 were minimal with the largest movements occurring into the Fraser River and Strait of Georgia areas. Between 1990 and 1997 annual area selection allowed for fleet movement and there were consistent increases in vessels electing to fish Area A in response to increased crab abundance. The numbers of vessels electing the West Coast, Area E, and the North Coast, Area B, declined over the same period (Table 4.1.6).

Effort in vessel days increased to a maximum observed in 1996 (Table 4.1.1, 4.1.3, 4.1.5) then declined to 1999. The decline in Area A effort was largely due to closures initiated to protect crab during moulting and to reduce trap abandonment and neglect. Effort in vessel days doesn't consider increases in effort due to larger trap inventories or other changes to fishing power. For example, the amount of gear in Area A continued to increase until discussions of trap limitation began in 1997. A ballot of Area A fishers in

1997 estimated the inventory at over 50,000 traps. Harvest logs showed a steady increase in trap inventories coast wide prior to trap limitation. Trap loss is estimated at 10 to 15 percent annually.

4.1.3.5. Consultative Process

The Crab Sectoral Committee (CSC) is the forum for advice for development of the annual crab management plan. The CSC is made up of representatives from First Nations, recreational fishermen, commercial fishermen, the provincial government and other stakeholders. Each commercial fishing license area has an elected representative on the CSC. Elected representatives sit on the committee for a 3 year term. Representatives for the crab marketing and processing sector are appointed to the CSC.

The consultative process begins as draft management plans are sent out to all coastal First Nations and representatives of the CSC for local discussion and comment. Commercial crab fishermen are consulted through local area associations for area specific advice and then through the CSC for regional advice. Local meetings are held at least annually but often 2 or 3 times before the representatives go to the CSC. The CSC meets annually to discuss and present issues pertaining to management of the crab fishery and to provide advice to the managers on the issues presented in the management plan.

The Aboriginal Fisheries Strategy (AFS) is Canada's program for the management of First Nations' fisheries and for the involvement of First Nations in other aspects of fisheries management. The AFS provides a structure within which First Nations are regularly consulted regarding the fisheries pertinent to their sustenance and livelihoods. Crab managers also meet with First Nations as issues arise. Often, First Nations' issues are specific to local areas and it is necessary to arrange meetings between First Nations' fishermen and local commercial and recreational fishermen rather than attempt to deal with local issues at the CSC. Joint Technical Committees exist between Fisheries & Oceans and some First Nations.

Recreational fishermen are consulted through the Sport Fishing Advisory Board which holds regular meetings of local subcommittees which report to a regional board. Recreational fishermen also hold a seat on the CSC. Crab management issues for recreational fishermen most often concern specific local areas and it is necessary to consult locally, rather than regionally.

4.1.3.6. Management Styles

Crab fishery management in British Columbia has been described as passive. Management of all Dungeness crab fisheries in North America has been coined three "S" management as an acronym for size, sex and season: That is, management of crab resources are based on size limits and a sex restriction and, in some areas, seasonal closures.

Size limits are used as the primary conservation measure in the Dungeness crab fishery. In British Columbia the size limit is 165 mm across the maximum breadth of the carapace. The size limit is designed to protect sexually mature male Dungeness crab for at least one year prior to harvest. Female Dungeness crab rarely exceed the 165 mm size limit but are further protected from the commercial fishery through a sex restriction that limits the harvest to male crab only. Undersized and female crab must be returned to the water immediately upon capture. The protection of females and a significant portion of the mature males in Dungeness crab populations ensures that harvestable stocks will be sustained in perpetuity.

The Dungeness crab fishery is not managed to a total allowable catch; maximum harvest levels are determined by the size limit. Other conservation measures include biodegradable escapement devices on traps to limit ghost fishing, escape holes to allow small crab out of traps and seasonal closures to protect moulting crab and small crab from the effects of handling. Note that all of these measures are aimed at protecting undersized and female crabs from possible harmful effects of the fishery.

Capitalization into crab fishing fleets has necessitated that more active management strategies be incorporated. Increased trap inventories, larger and faster boats, and improved crab storage capacity has made the commercial fleet more efficient. The result is a more intense fishery where undersized and female crab may suffer due to increased handling. Handling effects are not well known but managers and fishermen intuitively acknowledge increased mortalities with increased handling. Although actual fishery effects on conservation of crab are unknown it is unlikely that Dungeness crab would be extirpated in areas of intense fisheries. However, intensity does significantly effect the economics and sustainability of the fishery.

4.1.4. Stock Status

4.1.4.1. Biology

Crabs are dioecious. Mating takes place from April to September. Hard shelled males grasp females in a premating embrace. The mating embrace and copulation follow after the female crab moults. After copulation a "sperm plug" that imprisons the spermatozoa within the spermatheca closes the cavity of the oviduct. Females can retain sperm for more than one year and essentially all females are inseminated even in areas of the most intense fisheries where there are significant removals of male crabs. (Hankin *et al.* 1997) Eggs are fertilised as they are extruded on to the pleopods in late fall. Burial in sand is required for successful adhesion of eggs to pleopods. Eggs are brooded by the female through the winter until the larvae hatch off the female in spring. The larvae are planktonic for 3 to 4 months and go though 5 zoeal stages before reaching the final free swimming stage, the megalops. Crab larvae settle and metamorphose quickly into juveniles that look much like the adults.

Crab growth is spasmodic. A new shell forms inside the old and a split develops between the abdomen and the carapace. The crab emerges from the old shell and swells 20 to 30 % in size. Crabs are extremely vulnerable during this moulting process, as the new shell is very soft. The shell gradually hardens in a process that takes between 6 weeks and 2 months. Crab mature at 2 years and recruit into the fishery at 3 to 4 years. Maximum age is estimated at 7 or 8 years. Maximum size for females is approximately 180 mm and maximum size for males is approximately 270 mm across the maximum breadth of the carapace.

4.1.4.2. Assessment

Assessment of abundance is not undertaken and forecasts are not attempted.

A study of Dungeness crab in the Nass River estuary to determine the effect of the commercial fishery on crab availability for First Nations use began in May 2000.

4.1.4.3. Research

There has been some research into moult timing, growth and fishing related mortalities on the Fraser River. Some research has been conducted into juvenile distribution and habitat usage in Area A.

4.1.4.4. Prospects

Dungeness crab fisheries in British Columbia are fully utilised. Most of the crab fisheries appear stable except for the fishery around the Queen Charlotte Islands, which has declined from a peak in 1993. This decline was expected as the recruitment event waned. Crab fisheries are expected to remain very intense even with the incorporation of effort measures such as trap limits.

4.1.5. Management Issues

Current management issues are not related directly to conservation as it is unlikely that Dungeness crab are vulnerable to extirpation in any part of their natural range in British Columbia.

Major management concerns for crab fisheries are based around allocation and capitalization into the commercial fleet has made the fleet extremely efficient and competitive. This creates problems in providing opportunities for aboriginal and recreational fisheries, as they cannot be successful in areas where they are competing with the commercial fishery. Draft policies have been completed in the region to deal with requests for access to shellfish by aboriginal and recreational fishermen.

Capitalization into the commercial fishery has also lead to questions around the sustainability and economics of commercial crab fishing. Managers worked with the commercial industry to implement trap limits coast wide effective May 1, 2000. The objectives are to reduce capitalization into traps, reduce the abandonment, loss and neglect of traps, reduce congestion of the grounds and reduce effort. Effort reductions may not be realised because fishermen are expected to make up the short fall through increased trap hauls and other changes to their fishing patterns.

A major issue with commercial fishermen is the theft of crab traps and of the catch from their fishing gear. Fishermen in Area A will use vessel based cameras linked to a global positioning system to monitor on board activities.

Catch is the only index of abundance in the crab fisheries. There is a lack of catch reporting structures for the First Nations and recreational fisheries. Poor catch reporting and fraudulent catch reporting plague any analyses of catch data from the commercial crab fishery.

4.1.6. Long Term Objectives

Biological objectives for Dungeness crab fishery were developed as part of regional biological objectives for the Pacific Scientific Advice Review Committee (PSARC) of the Department of Fisheries and Oceans (Rice *et al.* 1995). Biological objectives are to:

- Ensure that the population (or subpopulations) of Dungeness crabs along the B.C. coast do not become biologically threatened throughout their ecological range.
- Ensure the reproductive capacity of crab stocks is protected and maintained in the face of fishing activity.
- Ensure that a fishery for Dungeness crab does not violate the above two objectives for other ecologically related species.

- Ensure that habitat for both juvenile and adult crabs is not destroyed or alienated.

4.1.7. Specific Management Objectives

4.1.7.1. Conservation / Sustainability

Conservation objectives are met and will most likely be maintained using the current management strategy. Natural fluctuations in Dungeness crab populations do not allow for a steady state or equilibrium harvest, consequently fisheries are not managed to a total allowable catch, nor is management of this sort anticipated (Butler 1984). Conservation objectives are met through maintenance of the reproductive potential of crab stocks. Fundamental goals are to protect female crab and only harvest male crab after they have had the opportunity to breed. Maintaining sustainability of the fisheries and determining allocations will be the most difficult objectives to meet in the future. Capitalization into the commercial fishery is a problem that will be partially addressed through trap limits.

4.1.8. Fishery Management Measures

Management actions for the crab fishery are detailed chronologically in Table 9.

4.1.8.1. Fishing Season

First Nations and recreational fisheries are open year round. Commercial fisheries may be seasonal around soft shell closures as noted below.

The Fraser River and Boundary Bay fisheries (Areas I & J) have been intensively fished for decades. The Fraser River opens in late June. Boundary Bay opens in late July. Both fisheries are monitored prior to opening to determine whether the majority of the crabs are hard enough to market. Most of the crabs are caught in the first six weeks of the fisheries that ensue.

Crab fisheries around the Queen Charlotte Islands (Area A) have included soft-shell closures in Naden Harbour and McIntyre Bay since the 1950's. These closures generally occur between May and late September. In recent years Hecate Strait has also closed at various times between March and August with reopening based on industry funded monitoring. Management is currently in the process of adapting the Hecate Strait closure to the most appropriate time by using information provided by the test fishery and the fleet. A winter closures was attempted in 1998/99 but the March 1 opening occurred just prior to a moult event which required an emergency closure.

There are no soft-shell closures on the North and Central Coast Mainland (Area B), Johnstone Strait (Area G), or the Strait of Georgia (Area H). These fisheries are based on multiple estuaries and small sandy locations that hold populations of crab that fishermen report to have different moult timing which are not consistent from year to year. A similar situation appears to exist on the West Coast of Vancouver Island (Area E) where the combination of small estuarine populations and larger but broken beach populations lead to an inconsistent pattern of moulting. There may be opportunities for localised soft-shell closures in the future if better information on moulting patterns is obtained.

4.1.8.2. Control and Monitoring of Fishing Activities

Control and monitoring of the crab fishery is through opportunistic enforcement and through an industry funded program designed around the trap limitation initiative. In Area A the fishery is monitored through the use of video surveillance and positioning equipment on board each vessel. In other areas industry funds vessel based monitors that board and inspect crab fishing operations at sea.

Monitoring also occurs through reports by fishermen via fish slips and harvest logs.

4.1.8.3. Quota Allocations

Crab fisheries are not managed to a total allowable catch so allocations have been provided by excluding commercial fishing from some areas to allow for access by First Nations and recreational fishermen.

4.1.8.4. Size Limit

Size restrictions have been the primary management tool for Dungeness crab populations since 1906 when a 6-inch (153 mm) size limit was initiated. This limit was changed to 6.5 inches (165 mm) in the 1910's (Jamieson 1984). The 165 mm minimum size limit (measured across the maximum width of the carapace, commonly called "spine to spine") was designed to protect sexually mature male crabs for at least one year prior to harvest. Few females reach the size limit but were protected from the commercial fishery by a regulation from 1926 to 1957 that prohibited the retention of ovigerous females. This regulation was revoked as redundant with the size limit in 1957, however, it was reintroduced as a condition of licence in the commercial fishery prohibiting retention of all females in 1992.

4.1.8.5. Licensing

Sport fishers have been required to have a British Columbia Tidal Sport Fishing licence to harvest shellfish since 1995. Sport Fish licences are issued annually on a "fiscal year" from April 1 to March 31.

Aboriginals have been licensed to harvest crab under Communal Aboriginal Fishing Licences issued to Native bands since 1992. Native bands designate or issue licences to aboriginal harvesters.

Licensing of the commercial crab fishing fleet began in 1966 with the licensing of other commercial fisheries. All three of the initial salmon licence categories issued, A, B and N, were authorised to harvest crab. Subsequent licence categories C (General), G (Geoduck), K (Sablefish), L (Halibut), S (Shrimp Trawl) and T (Groundfish Trawl) also included the authority to harvest crab using traps for a maximum potential fleet of over 6000 vessels. Prior to 1990, annual landings had been made by as many as 386 vessels. An R category licence for crab was initiated by the Department in 1990 in response to high levels of fishing effort on crabs. The Department limited the number of R licences to 223 in 1991. The licence eligibility criterion was 15,000 pounds cumulative landings over the three year period from 1987 to 1989. The number of eligible licences fluctuated slightly after licence limitation due to licence appeals (Table 6).

The R licence includes Dungeness crab, Red Rock crab (*Cancer productus*), Graceful crab (*Cancer gracilis*), Red King crab (*Paralithodes camtschatica*) and Golden King crab (*Lithodes aequispina*). Landings of Red King crab are presented in Table 7. Commercial landings of Red Rock crab, Graceful crab and Golden King crab have not been significant and do not appear in the British Columbia catch statistics.

Typically commercial licences are issued on the calendar year from January 1 to December 31. The 1999 licence was extended to end on April 30, 2000. Licence holders were required to designate their vessel to a licence area by January 15, 2000.

This date had been recommended by industry to allow a maximum time for area selection based on a year end of December 31. However, it was realised that implementation of trap limits could not occur without special licence conditions and issuing licences twice in 2000 would also require collection of licence fees twice. Managers opted to extend the 1999 licence year but provided a management plan and area re-selection on the calendar year. Conditions of licence were amended to include the period of January 1 to April 30.

4.1.8.6. Crab Areas

Area licensing was implemented with the R license in 1990; crab fishers were required to choose one of six licence areas annually. Annual area selections were altered in 1992 when fishers could choose between five licence areas and all licensed fishers could fish the offshore area. These areas are described in Table 8. Two areas were divided in 1997 to form a total of 7 licence areas. The distribution of licences by area for 1990 through 2000 is shown in Table 6. Representatives from Area A lobbied the Crab Sectoral Committee and DFO to extend the period that vessels were designated in an area. Beginning 1997, licence holders selected a licence area for a period of 3 years. Boundary Bay was separated from Fraser River on a one year trial basis in 1997 and the separation was made permanent in 1998. Licence holders were able to designate new areas for the 3 year period 2000 to 2002.

4.1.8.7. Escape Holes

Handling mortality of undersized, female, and soft shelled crab remains a concern in the fishery. All traps have been required to be fitted with an escape hole of 100 mm to allow undersize crabs to escape since 1990. Subsequent to the 1991 PSARC review of a proposed escape ring size increase from 100 mm to 110 mm, it was announced that the new ring size would become effective in 1992. There was continued concern on the part of the fishermen with regard to the loss of legal crab with the larger ring size. Public meetings were held early in 1992 to discuss the research and rationale for the ring size change. Due to delays in consolidation, the ring size change was delayed to 1994. In 1994, implementation of the 110 mm rings was again delayed in response to strong lobbying by the crab industry. The Department agreed to investigate the possibility of closures during soft shell periods as an alternative to larger escape holes, however, no agreement was reached between fishers and DFO on appropriate times for soft shell closures. Fishers in Area B opted for 110 mm escape holes effective January 1, 1998 after a three year phase in period.

4.1.8.8. Biodegradable Escape Mechanisms

"Ghost fishing" is common to trap fisheries: Lost fishing gear continues to cause mortalities as crab enter the trap, die and bait the trap with their bodies, or are cannibalised by new entrants drawn to the activity of other crab in the trap. Destructive mechanisms have been incorporated to prevent traps lost in the fishery from continuing to fish. Rigid frame traps with hinged lids must be fitted with a biodegradable cord on the lid tie down. Use of rot cords was limited to hinged lid traps with a volume less than 400 litres effective 1997 in response to large crab traps with unsecured lids that remained closed due to their weight. The weight of the cord required was varied from #36 in 1990, to #54 in 1991, and to #120 in 1992 to reduce premature rotting. Traps without hinged lids must be fitted with a square panel, 11 cm per side, laced in with biodegradable cord (called a "rot panel"). The panel size was varied from 20 cm per side to 11 cm per side in 1993. Rot panels were varied in Areas A and B in 1997 to 35 cm by 35 cm or a "V" measuring 50 cm on each leg to protect king crab. Biodegradable escape mechanisms were incorporated in the sport fish regulations in 1996. The majority of aboriginal licences were issued with conditions requiring destructive devices in 1995.

4.1.8.9. Trap Limits

A trap limit of 125 traps per licence was implemented for the Tofino fishery in 1991 and a 300 trap limit was initiated in the Fraser River in 1995. Trap limits were initiated to reduce problems of congestion on the fishing grounds. A trap limit of 400 traps per licensed vessel was initiated in the North and Central Coast Mainland (Area B) in 1998 as a pilot to evaluate costs associated with trap limits. Trap limits were implemented in all remaining areas beginning May 1, 2000. Trap limits in Area A were based on vessel length:

600 traps per vessel less than 42.5 feet (13m) in length;

800 traps per vessel from 42.5 to 46 feet (14m) in length;

1000 traps per vessel from 46 to 52 feet (15.8m) in length; and

1200 traps for vessels in excess of 52 feet in length.

Trap limits in other areas were equal allocations per vessel: 300 traps in Areas I & J, 400 traps in Area B and 500 traps in Areas E, G & H.

Single trap gear was required in Boundary Bay in 1997 to alleviate problems of fishers setting gear over one another. A single trap gear restriction effective January 1, 2000 for Area A was advanced to May 1, 1998 in response to illegal activity during the soft shell closure in 1997. A minimum size was set for crab buoys in 1997 due to continued complaints regarding the navigational hazards of gear marked with small (gillnet) floats.

4.1.8.10. Soft Shell Closures

The Fraser River area has had an annual soft shell closure since 1983. The timing of the closure varied prior to 1990 but was from January to mid-July from 1990 to 1996. Managers and charter operators monitor openings to ensure that crabs are hard enough. Openings were tailored to each area when Boundary Bay was separated from the Fraser River area in 1997 (Table 8). Fishers had experienced a later soft shell period in Boundary Bay.

Significant incidences of soft crab have been experienced annually in Hecate Strait since 1993. Fishers attempted several "gentlemen's agreements" in 1994 and 1995 to move gear away from areas of soft crab or to leave gear open and unbaited during periods of soft crab. These attempts could not be enforced by DFO and failed due to lack of co-operation from the fleet. A closure of all of Area A was initiated in 1996 for the period of June 1 to July 15. DFO recovered 380 illegal traps during the closure and it became evident that DFO vessels were poorly equipped to deal with gear recovery in Hecate Strait and Dixon Entrance. Fishers agreed to fund a monitoring program through crab caught in a test fishery in 1997. Two vessels were chartered to monitor soft crab during the closure and recover illegal gear. Fishers opted to extend the closure to July 31 when it was evident that the majority of crab weren't hard enough for the market. The charter vessels recovered over 1300 illegal crab traps. Charter captains estimated that they recovered about a third of the illegal gear. Most of the illegal traps were on long lines and were baited heavily to fish through the closure. The results were that fishermen opted to limit Area A to single trap gear only and to continue to charter test fishing vessels to monitor soft shell and gear recovery. Charters tended to dissuade some of the gear left fishing during the closed time.

The Area A soft shell closure June 1 to July 15 was timed closely with moulting in 1996 and 1997 but in 1998 a portion of the Hecate Strait crab population moulted in March and the rest moulted in May.

4.1.8.11. Winter Closures

A portion of the fleet has proposed a winter closure of Area A since licence limitation in 1991. Fishers argue that although crab are mostly hard shelled and the market is strong, the weather is so severe that trap loss and neglect and the resulting crab mortalities are high. The initiation of a winter closure December 1 to March 1 in Area A in 1998/99 turned out to be poorly timed because of a large moult event in late April. Fishers had just employed most of their gear on the grounds when the crabs began to moult. This resulted in an emergency closure of the fishery May 5, 1999. Fishers opted to allow the winter fishery to happen in 1999/2000 but to close the fishery March 1 to July 15, 2000 to try to capture most of the moulting period. This adaptive management would have been impossible without the co-operation of the fleet in providing part of the catch for test fisheries and information on the incidence of moulting.

A winter closure of Khutzemateen Inlet was initiated after 1999 when traps could not be attended properly in the inlet due to ice conditions.

4.1.8.12. Access Closures

There are numerous closures to the commercial fishery to provide access to aboriginal and recreational fisheries. These closures are in two forms; seasonal closures for a portion of the year where native and recreational fishers are provided first access to crab, and permanent closures for the entire year where native and sport fishers have the only access to the crab. Most of these closures are in Area B.

4.1.8.13. Contamination Closures

As benthic scavengers, crabs may accumulate toxins, either naturally occurring or introduced. Area 27 was closed in 1993 and Areas 1, 101, 102, 104 and 105 were closed September 7, 1995 due to domoic acid contamination. In 1995, fishers quickly provided samples from the area that resulted in most of the area being reopened, however Subarea 101-10 remained closed until January 1996. Many areas have been closed to crab fishing due to contamination by dioxins and furans, primarily from pulp mills (Table 10). Increased control on the release of contaminants by industry has reduced the number of closures in recent years.

The removal of the contamination closure from Cowichan Bay created an allocation problem for managers. Sport and Native fishers, subject only to a hepatopancreas consumption advisory prior to 1995, were against the reintroduction of commercial fishing in the area. The area was finally designated closed to commercial fishing for Native and Sport access after lengthy consultations. This issue highlighted the need for policy on the allocation of crab resources. Several proposals are received annually from native and sport groups to designate areas non-commercial. A portion of Port Renfrew was closed to commercial fishing in 1998. Work is in progress by a subcommittee of the Shellfish Working Group on allocation policy for shellfish with the objective of a consistent approach to closure requests.

4.1.8.14. Other Restrictions

The activity of moving gear and crab to and from the grounds was limited to the licensed vessel in 1996. This restriction was implemented when fishers planned to fish Area A using mother ships and barges to facilitate operations from small catcher vessels. Managers wanted to maximise the effort limitation inherent in vessel length restrictions and fishers wanted to protect their investments in boats and licenses. The condition was modified in 1997 to allow fishers in Fraser River and Boundary Bay to use barges on opening day only. The trap limit in the Fraser River area and the dangerous conditions in the river were cited in this allowance.

Theft of crab traps and catch was a significant problem in Area A. A condition to mark all traps with the vessel registration number was implemented in 1998 in Area A to assist Fisheries Officers and the RCMP with enforcement. Fishermen still report problems with theft and have proposed the use of vessel based cameras as a deterrence.

The use of "ribbon boundaries" was challenged in court so closures were changed in 1997 to incorporate point to point or latitude/longitude descriptions. Officers have had particular problems with the Kinkolith Native and Sport Access closure.

Crab fishers were permitted to haul crab gear only between 1 hour before sunrise and 1 hour after sunset in the Fraser River area beginning in 1994. The same condition was implemented in Johnstone Strait and the Strait of Georgia in 1998. This assists enforcement by limiting crab fishing activity to daytime hours.

4.1.9. Enforcement Issues and Strategies

Enforcement of the crab fishery is on an opportunistic basis, as the fishery does not command a priority within the region. Few directed enforcement activities are undertaken and most of the enforcement is reactive.

Conservation in the crab fishery is assured by the size limit, the commercial sex restriction, seasonal and area closures, escape mechanisms (escape holes and rot chords or panels), and catch monitoring. Thus the most serious offences threatening conservation are retention of undersized crab, commercial retention of female crab, fishing in closed areas, not using escape mechanisms and improper reporting of catch. Crab fishers have recommended licence sanctions for serious offences.

Retention of undersized crab is more prevalent in the North Coast Mainland and around the Fraser River. Intensive fisheries in these areas quickly harvest most legal sized crab early in the season. The retention of undersized crab by the sport fleet is more prevalent in the Fraser River area. This practice is not as common by the sport fleet in Area B since the area has the greatest amount of crab habitat allocated to sport and native fisheries on the coast.

Poaching in closed areas represents a serious problem that continues in many closed areas.

Failure to report catch and fraudulent reports of catch are chronic in the crab fishery. A "point of landing" requirement for fish slips was suggested by the Shellfish Working Group in 1994 but was tied up with national requirements. Third party validation of crab landings was considered in 1996 for North Coast Areas A and B but there was little support from crab fishers. Submission of fish slips and harvest logs remains difficult to enforce. Currently, reporting infractions are offences under conditions of licence that must be settled in court. Officers have suggested a system of voluntary penalty tickets as an option to reduce the amount court time. This option hasn't been exercised since it would require all conditions to be set out in regulation; a lengthy process that isn't as flexible as conditions of licence. The incentives provided through fraudulent receipt of employment insurance and taxation avoidance have outweighed the deterrent effect of enforcement.

The lack of integration of information between the sectors within DFO (Conservation and Protection, Fisheries Management, Licensing, Statistics, and Science) makes it difficult to identify and investigate illegal activity. Officers need efficient access to information that allows the correlation of fishing activity observed with harvest logs and fish slips. This issue was highlighted as a high priority PSARC recommendation in 1994. There have been improvements in the area of data sharing but information has not been integrated.

Incidents of neglect and abandonment of gear increased as trap inventories increased. One of the objectives of trap limits coast wide is to reduce or eliminate neglect and abandonment. The current regulation that gear must be checked every 14 days is difficult to enforce.

Vessels and manpower available to enforce the crab fishery are limited and enforcement of the crab fishery is a low priority within the Pacific Region. The crab fishery occurs over a very large geographic area. The current management practice of concurrent openings over most of the coast makes enforcement actions unlikely in much of the region.

4.1.10. Financial Responsibilities

4.1.10.1. Industry

Prior to 2000 funding of crab programs by the commercial fishery was limited to funding trap tags in the Fraser River area (approximately $4000 annually) and charters for soft shell monitoring in Area A. (Area A charters are bid in pounds of crab but the value is estimated between $50,000 and $90,000 annually). Industry also pays for harvest logs and the associated data entry fee.

The trap limit monitoring initiative implemented May 1, 2000 required vessel activity reports, trap tags and tag reports and inspections at sea. This program was the responsibility of industry to arrange. These arrangements were made between fishers and service companies. As of June 2000 only two companies provided this service. Total cost of the program is estimated at $1M in 2000. Most of the cost was in Area A for the purchase of video and positioning equipment. The Area A costs are expected to be much less in future years (estimated at $4000 per vessel). Costs in other areas was around $1000 per vessel for a total of approximately $200,000.

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Table 4.1.1. Annual catch and effort for commercial dungeness crab fishery, 1980 to 2000, as reported on sales slips.

Year	No. of Licenses	Catch (tonnes)	Effort (landing days)	CPUE (tonne/day)	Value ($'000)	Price ($/kg)
1980	343	1,701.0	13,369	0.13	N/A	N/A
1981	366	1,314.5	12,336	0.11	N/A	N/A
1982	352	998.5	12,097	0.08	N/A	N/A
1983	369	957.0	12,987	0.07	3,319.8	3.47
1984	387	1,155.6	15,730	0.07	4,557.7	3.94
1985	362	1,164.1	16,841	0.07	4,719.2	4.05
1986	386	1,319.5	19,559	0.07	5,660.9	4.29
1987	363	1,630.6	19,828	0.08	6,451.6	3.96
1988	331	1,507.9	16,435	0.09	5,945.8	3.94
1989	330	1,518.5	17,787	0.09	6,028.4	3.97
1990	497	2,129.4	19,929	0.11	8,919.1	4.19
1991	223	1,857.8	17,747	0.10	8,340.8	4.49
1992	224	3,333.6	18,283	0.18	11,008.0	3.30
1993	224	6,289.2	17,450	0.36	18,607.1	2.96
1994	223	5,995.3	20,568	0.29	25,622.0	4.27
1995	223	4,539.2	20,919	0.22	23,183.8	5.11
1996	221	5,024.6	25,005	0.20	23,548.1	4.71
1997	220	3,922.5	24,163	0.16	28,565.0	7.40
1998	220	2,968.1	22,632	0.13	21,426.2	7.22
1999	220	2,933.8	19,944	0.15	20,334.2	6.93
2000	221	2,700.6	19,887	0.14	19,466.0	7.21

Source: BC Catch Statistics.
1999 to 2000 data is preliminary.

Table 4.1.2. Dungeness crab landings (tonnes) by licence area, 1980 to 2000.

Year	Area A (QCI)	Area B (NCCM)	Area C (GSJS)	Area D (FR)	Area E (WCVI)	Total
1980	901.0	107.0	215.0	252.0	226.0	1,701.0
1981	548.4	126.3	171.7	229.5	238.6	1,314.5
1982	257.3	78.8	127.4	260.5	274.5	998.5
1983	141.6	160.9	141.6	274.0	238.9	957.0
1984	152.3	141.8	277.5	340.9	243.1	1,155.6
1985	166.3	107.6	180.8	352.5	356.9	1,164.1
1986	219.0	98.9	261.0	321.2	419.4	1,319.5
1987	257.6	135.4	230.1	424.3	583.2	1,630.6
1988	378.6	139.6	225.3	456.3	308.1	1,507.9
1989	351.5	237.3	227.6	407.9	294.2	1,518.5
1990	777.7	275.2	314.6	414.6	347.3	2,129.4
1991	447.9	434.8	305.2	314.9	355.0	1,857.8
1992	1,600.3	418.5	362.0	447.1	505.8	3,333.6
1993	4,798.0	282.2	419.1	491.1	298.8	6,289.2
1994	4,272.5	354.8	537.2	445.9	384.9	5,995.3
1995	2,728.8	474.1	434.1	645.4	256.8	4,539.2
1996	3,362.8	405.5	575.7	401.6	272.5	4,930.7
1997	2,110.3	225.6	562.7	502.2	470.5	3,871.3
1998	1,100.6	165.9	595.1	571.9	485.4	2,918.9
1999	1,414.0	128.2	493.1	511.6	235.6	2,782.5
2000	914.7	178.7	655.8	544.7	406.8	2,700.6
G/H and I/J for 1997			133.5 / 429.4	340.3 / 161.9		
G/H and I/J for 1998			120.1 / 475.0	425.1 / 155.0		
G/H and I/J for 1999			112.6 / 380.5	391.0 / 120.6		
G/H and I/J for 2000			126.6 / 529.2	445.3 / 99.3		
Average						
1980-89	337.4	133.4	205.8	331.9	318.3	1,326.7
1990-00	2,138.9	304.0	477.7	481.0	365.4	3,758.9

Notes: Prior to 1988 the data includes all species of crab.

Prior to 1990 landings are reported by management areas (MA) from catch statistic with the following break down, Area A = MA 1 & 2, Area B = MA 3 to 10 inclusive, Area C = MA 11 to 19 inclusive, Area D = MA 28 & 29, Area E = MA 20 to 27 inclusive.

The offshore catch of 7.6 tonnes in 1990 was included in Area E.

Landings after 1990 are reported by area selected, not by MA reported on the fish slips due to reporting errors. See Table 8 for Area descriptions.

Table 4.1.3. Dungeness crab effort in vessel days by licence area, 1980 to 2000.

Year	Area A (QCI)	Area B (NCCM)	Area C (GSJS)	Area D (FR)	Area E (WCVI)	Total
1980	901.0	107.0	215.0	252.0	226.0	1,701.0
1981	548.4	126.3	171.7	229.5	238.6	1,314.5
1982	257.3	78.8	127.4	260.5	274.5	998.5
1983	141.6	160.9	141.6	274.0	238.9	957.0
1984	152.3	141.8	277.5	340.9	243.1	1,155.6
1985	166.3	107.6	180.8	352.5	356.9	1,164.1
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1987	257.6	135.4	230.1	424.3	583.2	1,630.6
1988	378.6	139.6	225.3	456.3	308.1	1,507.9
1989	351.5	237.3	227.6	407.9	294.2	1,518.5
1990	777.7	275.2	314.6	414.6	347.3	2,129.4
1991	447.9	434.8	305.2	314.9	355.0	1,857.8
1992	1,600.3	418.5	362.0	447.1	505.8	3,333.6
1993	4,798.0	282.2	419.1	491.1	298.8	6,289.2
1994	4,272.5	354.8	537.2	445.9	384.9	5,995.3
1995	2,728.8	474.1	434.1	645.4	256.8	4,539.2
1996	3,362.8	405.5	575.7	401.6	272.5	4,930.7
1997	2,110.3	225.6	562.7	502.2	470.5	3,871.3
1998	1,100.6	165.9	595.1	571.9	485.4	2,918.9
1999	1,414.0	128.2	493.1	511.6	235.6	2,782.5
2000	914.7	178.7	655.8	544.7	406.8	2,700.6
G/H and I/J for 1997			133.5 / 429.4	340.3 / 161.9		
G/H and I/J for 1998			120.1 / 475.0	425.1 / 155.0		
G/H and I/J for 1999			112.6 / 380.5	391.0 / 120.6		
G/H and I/J for 2000			126.6 / 529.2	445.3 / 99.3		
Average						
1980-89	337.4	133.4	205.8	331.9	318.3	1,326.7
1990-00	2,138.9	304.0	477.7	481.0	365.4	3,758.9

Notes: Prior to 1988 the data includes all species of crab.

Prior to 1990 landings are reported by management areas (MA) from catch statistic with the following break down, Area A = MA 1 & 2, Area B = MA 3 to 10 inclusive, Area C = MA 11 to 19 inclusive, Area D = MA 28 & 29, Area E = MA 20 to 27 inclusive.

The offshore catch of 7.6 tonnes in 1990 was included in Area E.

Landings after 1990 are reported by area selected, not by MA reported on the fish slips due to reporting errors. See Table 8 for Area descriptions.

Table 4.1.4. Commercial Dungeness crab landings (tonnes) by Area, 1980 to 2000.

AREA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	TOTAL
1980	773.0	128.0	14.0	59.0	24.0	8.0	0.5	0.5	0.5	0.5	1.0	54.0	2.0	0.5	0.5	2.0	27.0	35.0	93.0	53.0	22.0	2.0	1.0	130.0	9.0	6.0	3.0	19.0	233.0	1,701.0
1981	487.7	60.7	14.0	99.6	6.8	5.5			0.3	0.1	0.4	29.3	0.8	0.0	0.1	10.8	14.7	40.2	75.4	35.2	2.0	4.9	3.9	175.1	10.3	4.7	2.5	14.5	215.0	1,314.5
1982	237.2	20.1	1.9	74.9	0.7	0.7	0.1		0.3	0.2	0.1	27.6	0.7	3.1	0.2	1.1	21.5	23.2	49.9	93.1	2.0	2.1	2.9	156.9	5.8	7.4	4.3	9.5	251.0	998.5
1983	135.6	#	6.7	148.6	2.6	2.4	#		#	0.3	2.3	38.8	8.9	1.1	#	0.3	39.0	28.8	22.3	57.4	5.9	#	25.2	136.3	7.1	2.5	3.3	20.8	253.2	957.0
1984	146.2	6.1	22.0	105.6	1.6	2.2	6.5		3.8	#	#	74.1	20.2	0.5	1.5	#	54.8	52.5	73.6	80.9	1.3	12.0	30.2	109.5	1.9	2.6	4.7	48.0	294.9	1,156
1985	160.3	6.0	34.3	65.2	1.0	4.1	2.2		#	#	0.5	42.4	2.5	2.1	#	0.6	49.8	19.6	59.5	158.3	2.3	4.9	32.0	151.7	3.9	1.1	4.7	26.9	325.6	1,164
1986	205.5	#	17.8	57.7	11.1	6.3	4.7	#	#	0.4	0.3	53.7	25.6	5.2	0.9	4.1	30.9	42.6	97.7	113.3	3.6	2.1	20.9	265.0	5.6	3.0	5.9	24.0	297.2	1,320
1987	246.0	11.6	9.1	104.2	#	11.2	#	2.3	0.8	2.9	1.2	71.6	2.5	#	0.9	5.3	20.9	18.2	89.3	92.7	#	8.2	9.0	449.2	9.9	3.1	10.7	3.7	420.6	1,631
1988	352.4	26.2	53.0	75.9	#	7.3	1.4		1.3	#	20.1	76.7	2.5	0.6	2.5	1.0	40.4	31.0	50.4	40.8	1.2	#	8.1	227.2	8.0	2.2	17.3	8.3	450.0	1,508
1989	343.4	#	#	197.8	6.6	15.4	4.1	1.8	#	9.5	1.5	43.8	10.2	#	2.0	6.7	36.2	52.2	73.5	32.5	9.1	7.2	22.8	202.8	12.2	1.7	5.8	5.7	402.3	1,518
1990	667.2	82.4	11.4	267.7	10.2	10.8	#			3.6	2.4	115.0	9.6	#	#	3.6	27.6	24.7	117.4	74.0	9.4	#	4.7	222.8	22.0	6.8	14.3	40.5	374.7	2,129
1991	413.5	#	7.1	388.2	25.9	2.0	#			#	#	131.2	2.7	#	#	#	35.8	30.2	107.2	75.8	13.9	#	0.4	222.0	13.1	3.6	24.5	56.1	264.5	1,858
1992	1,070.9	460.8	1.3	405.6	54.2	20.3	#	#		#	#	143.9	#		#	#	56.5	40.1	109.8	124.6	#	#	2.7	300.0	20.3	#	23.9	40.9	402.1	3,334
1993	1,622.0	3,020.4	52.8	199.9	166.5	16.4					#	138.3	7.9			#	53.5	57.4	147.8	57.1	1.1	#	#	180.6	17.7	#	29.5	33.1	469.4	6,289
1994	1,315.5	2,772.3	110.1	298.3	100.3	37.0	#				2.5	112.2	8.9	#		#	98.4	109.6	213.9	114.0	6.5	#	0.9	181.7	14.8	4.0	56.7	62.3	357.1	5,995
1995	1,411.4	1,132.4	203.1	342.2	59.0	32.0		3.5	#	9.9	#	127.6	4.9	#	#	2.9	56.3	86.3	155.8	43.9	11.0	#	#	158.4	14.9	5.4	24.0	29.4	616.3	4,539
1996	1,738.7	889.6	140.0	776.0	179.8	19.9	#			13.4	12.2	136.3	5.5			#	59.7	147.5	231.1	92.8	#	#	#	139.8	#	#	24.9	74.7	325.5	5,025
1997	1,247.6	443.9	69.6	468.5	110.3	10.7	1.2	#	#	#		133.1	4.7	#	#	#	62.5	118.8	269.3	248.1	#	#	#	194.8	#	#	19.7	70.6	427.5	3,922
1998	577.2	296.4	67.5	295.2	31.5	9.3	3.9	#				113.2	7.4		#	#	96.7	126.8	259.8	214.4	3.9	#	#	208.5	#	#	#	84.6	502.0	2,968
1999	657.3	544.8	59.5	320.5	34.5	3.7	#	#		#		107.2	#	#	#	#	58.6	121.9	204.6	87.7	8.1		12.6	119.1			#	157.5	382.6	2,934
2000	350.4	315.6	61.6	287.5	71.2	6.8		#	#			105.6	13.5	#	#	#	118.5	128.6	257.4	125.0	26.2	#	12.7	228.2			#	171.6	392.7	2,701
Average																														
1980-89	308.7	28.6	17.4	98.8	5.9	6.3	2.0	0.5	0.8	1.5	2.8	51.2	7.6	1.5	1.2	3.2	33.5	38.3	68.5	75.5	5.0	5.2	15.4	200.4	7.2	3.4	6.2	17.6	314.3	1,327
1990-99	1,072.1	967.3	72.2	376.2	77.2	16.2	2.0	0.6	0.5	4.0	2.2	125.8	7.8	0.7	0.9	2.5	60.6	86.3	161.7	113.2	8.4	4.8	4.2	192.8	12.4	3.3	28.4	65.0	412.2	3,899

Data from B.C. Catch Statistics. 1998 to 2000 data preliminary.

# Data Confidential

Table 4.1.5. Commercial Dungeness crab effort (vessel days) by Pacific Fishery Management Area, 1980 to 2000.

AREA	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	TOTAL
1980	894	143	58	443	160	165	34	15	9	31	65	1,156	92	6	2	105	707	1,149	1,722	1,173	80	28	3	1,468	87	150	80	687	2,657	13,369
1981	753	126	67	442	97	82			7		27	673	55		1	389	436	902	1,469	744	30	86	36	1,777	74	184	79	283	3,517	12,336
1982	259	85	22	376	78	107	7		45	65	24	712	46	148	12	38	647	753	918	1,749	14	70	72	1,822	78	319	155	185	3,291	12,097
1983	394	26	125	1,367	39	27	7		35	44	99	817	345	80	7	118	1,041	832	795	1,738	107	10	239	1,869	299	113	73	236	2,105	12,987
1984	457	52	155	805	73	41	110		110	56	12	1,648	379	12	27	25	1,103	963	2,183	1,942	66	135	224	1,228	57	115	116	452	3,184	15,730
1985	474	66	426	736	56	120	62		14	55	11	1,228	199	28	67	8	918	639	1,806	3,809	32	123	524	1,391	117	85	185	334	3,328	16,841
1986	714	30	135	557	116	53	114	27	38	45	15	1,049	356	72	137	164	989	1,212	2,444	3,174	46	104	404	3,348	173	56	118	402	3,469	19,559
1987	714	85	152	857	31	52	10	35	44	55	20	1,514	274	8	92	213	684	1,158	2,914	2,375	10	209	142	4,946	172	68	234	111	2,649	19,828
1988	736	105	104	513	6	61	95		39	19	41	1,476	228	15	97	103	1,398	958	1,634	1,001	13	183	80	2,511	127	115	324	189	4,264	16,435
1989	923	11	21	596	64	144	51	9	40	21	79	905	493	28	74	226	1,490	1,841	1,647	813	79	127	474	2,634	274	105	203	209	4,206	17,787
1990	1,186	131	39	838	186	111	33			53	66	1,714	604	4	3	140	1,546	1,191	2,329	1,603	53	71	91	3,003	381	206	375	547	3,425	19,929
1991	1,189	113	101	1,706	212	35	10			29	12	1,365	197	2	6	1	1,039	847	1,982	1,249	177	46	15	3,225	185	72	407	486	3,037	17,747
1992	1,398	245	44	1,509	310	103	44	12		21	8	1,225	175		9	112	1,497	879	1,485	1,729	129	75	118	3,538	178	100	394	265	2,681	18,283
1993	1,647	798	339	1,266	286	169					13	1,871	283			105	1,036	756	1,581	971	12	169	25	2,550	186	117	360	227	2,683	17,450
1994	1,783	1,468	636	1,389	374	196	39				26	1,670	275	14		107	1,284	1,424	1,736	1,231	40	115	15	2,155	202	77	649	297	3,366	20,568
1995	2,235	1,273	1,130	1,635	307	146		83	77	77	17	1,698	231	8	5	74	1,340	1,466	2,370	1,001	69	24	10	1,685	220	115	433	245	2,945	20,919
1996	2,838	1,364	843	2,084	574	90	7			16	18	2,082	167			64	1,152	1,726	2,351	913	14	36	56	2,510	31	105	514	992	4,458	25,005
1997	2,011	1,066	665	2,369	510	70	16	4	7	5		1,948	175	9	13	80	1,225	1,983	2,628	1,844	44	66	40	3,378	6	42	445	441	2,873	24,163
1998	1,615	1,007	446	1,740	285	75	33	20				1,706	208		56	79	1,165	1,600	3,072	1,804	36	195	129	3,676	5	7	424	358	2,891	22,632
1999	1,346	976	365	1,231	195	24	9	7		3	9	1,323	270	43	50	96	944	2,245	2,728	1,681	70		169	2,805			408	704	2,245	19,944
2000	497	748	466	1,156	328	31		2	4			1,336	197	2	48	66	1,609	1,681	2,630	1,913	136	86	164	3,508			197	872	2,210	19,887
Average																														
1980-89	632	73	127	669	72	85	54	22	38	43	39	1,118	247	44	52	139	941	1,041	1,753	1,852	46	108	220	2,299	146	131	157	309	3,267	15,697
1990-99	1,725	844	461	1,577	324	102	24	25	42	29	21	1,660	259	13	21	86	1,223	1,412	2,246	1,403	64	89	67	2,853	155	93	441	456	3,060	20,664

Data from B.C. Catch Statistics updated April 2000. 1997 to 1999 data preliminary.

Table 4.1.6. Crab "R" Licences issued, 1990 to 2000.

LICENCE AREA	1990	1991	1992	1993	1994	1995	1996	1997
A. Queen Charlotte Islands	29	18	19	25	34	41	50	53
B. North & Central Coast Mainland	83	38	40	38	35	35	28	20
C. Johnstone & Georgia Straits	161	54	53	55	52	59	57	(56)
D. Fraser River	100	48	42	43	48	42	49	(47)
E. West Coast of Vancouver Island	121	65	70	63	54	46	37	44
F. Offshore	3							
Total	497	223	224	224	223	223	221	220

LICENCE AREA	1997	1998/99	2000
A. Queen Charlotte Islands	53	52	48
B. North & Central Coast Mainland	20	21	19
E. West Coast of Vancouver Island	43	43	39
G. Johnstone Strait	15	15	13
H. Strait of Georgia	42	42	48
I. Fraser River	31	28	36
J. Boundary Bay	16	19	19
Total	**220**	**220**	**222**

Notes:

1. Licence limitation was implemented in 1991.
2. The number of licences fluctuated between 1991 and 1994 due to appeals in the license limitation process.
3. Reductions after 1994 were due to licence retirements.
4. Licence Area C was split into Areas G and H in 1997.
5. Licence Area D was split into Areas I and J in 1997.
6. One licence retired to AFS in 1995 and 1 in 1997 were reinstated in 2000.

Table 4.1.7. King crab landings (kg) by Area, 1988 to 2000.

	Catch by Statistical Area							Total	Effort	Value
Year	1	2	3	4	5	6	26	Catch (kg)	(days)	($)
1988		#	#	656				3,069	116	48,837
1989	#			#			#	1,459	5	38,024
1990			33,605	#				34,509	83	374,404
1991			20,621	#	#			22,566	360	317,156
1992			10,772	#	#	#		15,308	298	180,774
1993			#		21,741	#		31,049	172	146,836
1994	#		#		#			#	77	#
1995	#		#	#	#	#		14,066	206	103,190
1996		3,868	7,199	772	#			12,259	314	167,296
1997			6,244	#	#	#	#	10,116	283	136,424
1998			#	#	#	#		3,253	179	51,424
1999			#	#				#	110	#
2000			#			#		#	60	#

Data source- B.C. Catch Statistics

1998 to 2000 data preliminary

# Data Confidential

Table 4.1.8. Management area descriptions and changes, 1990 to 2000.

Area	**1990 to 1996**	Areas as described in the Pacific Fishery Management Area Regulations
A	Queen Charlotte Islands	Areas 1, 2, and Subareas 101-7, 101-10, 102-1, 104-1 to 104-5 inclusive and 105-1
B	North Coast & Central Coast Mainland	Areas 3 to 10 inclusive
C	Georgia Strait and Johnstone Strait	Areas 11 to 19 inclusive and Subarea 29-5
D	Fraser River	Areas 28 and 29 excluding Subarea 29-5
E	West Coast Vancouver Island	Areas 20 to 27, and Subareas 121-1, 121-2, 124-1 and 124-3
	Offshore	Areas 103, 106 to 111 inclusive, 123, 125 to 127 inclusive, 130 and 142 and Subareas 101-1 to 101-6 inclusive, 101-8, 101-9, 102-2, 102-3, 105-2, 121-3, 124-2 and 124-4

Area	**1997 to 1999**	Areas as described in the Pacific Fishery Management Area Regulations
A	Queen Charlotte Islands	Areas 1, 2, and Subareas 101-7, 101-10, 102-1, 104-1 to 104-5 inclusive and 105-1
B	North Coast & Central Coast Mainland	Areas 3 to 10 inclusive
E	West Coast Vancouver Island	Areas 20 to 27, and Subareas 121-1, 121-2, 124-1 and 124-3
G	Strait of Georgia	Areas 11, 12, 13, and 15
H	Johnstone Strait	Areas 14, 16 to 19 inclusive and Subarea 29-5
I	Fraser River	Areas 28 and 29 excluding Subareas 29-5 and 29-8
J	Boundary Bay	Subarea 29-8
	Offshore	Areas 103, 106 to 111 inclusive, 123, 125 to 127 inclusive, 130 and 142 and Subareas 101-1 to 101-6 inclusive, 101-8, 101-9, 102-2, 102-3, 105-2, 121-3, 124-2 and 124-4

Area	**2000**	Areas as described in the Pacific Fishery Management Area Regulations
A	Queen Charlotte Islands	Areas 1, 2, 101 to 110 inclusive, 130 and 142.
B	North Coast & Central Coast Mainland	Areas 3 to 10 inclusive.
E	West Coast Vancouver Island	Areas 20 to 27 inclusive, 121 and 123 to 127 inclusive.
G	Strait of Georgia	Areas 11, 12, 13, 15 and 111.
H	Johnstone Strait	Areas 14, 16 to 19 inclusive and Subarea 29-5.
I	Fraser River	Areas 28 and 29 excluding Subareas 29-5 and 29-8.
J	Boundary Bay	Subarea 29-8.

Table 4.1.9. Management Actions of the Dungeness Crab Fishery

Year	Areas or Subareas	Management action	Area	MA	Currently In Effect	Year
2000	All	Area re-selection for the period January 1, 2000 to December 31, 2002	All	0	Y	2000
2000	All	1999 licences valid until April 30, 2000 to accomdate trap limits.	All	0	A	2000
2000	All	Trap limits and industry funded monitoring programs required coast wide effective May 1, 2000.	All	0	Y	2000
2000	All	Crab licence areas re-described. Offshore area eliminated.	All	0	Y	2000
2000	All	Octopus retention allowed as bycatch with special licence conditions requiring extra data collection.	All	0	Y	2000
2000	All	Harvest logs require fishing location by latitude and longitude.	All	0	Y	2000
2000	Area A	Area A closed March 1 to July 15, 2000 for softshell.	A	1	Y	2000
2000	101-1, 101-2, 101-3, 130 and 142	Areas 101-1, 101-2, 101-3, 130 and 142 open to retention of red and golden king crab March 1 to July 15.	A	1.101	Y	2000
2000	1-4	Naden Harbour closed March 1 to September 30 for soft shell.	A	1.4	Y	2000
2000	Ptn 1-5, 101-7, 101-10	McIntyre Bay closed from March 1 to September 21 for soft shell.	A	1.5	Y	2000
2000	3-10	Khutzemateen inlet closed January 1 to March 1 due to winter ice conditions. (traps cannot be properly tended)	B	3.1	Y	2000
2000	Area J	Area J will open July 31 to December 31, 2000.	J	29.8	Y	2000
1999	Area A	Area A closed to commercial fishing January 1 to March 1, 1999	A	1	N	1999
1999	Area B	400 trap limit in Area B, the North and Central Coast Mainland	B	3	Y	1999
1999	Area 24	Tofino 125 trap limit area expanded to include subarea 24-1 from April 1 to September 30 and subareas 24-2 through 24-14 for the remainder of the year.	E	24	Y	1999
1999	SA 25-9, 25-10, 25-13, 25-14	Subareas 25-9, 25-10, 25-13 and 25-14 closed due to domoic acid contamination	E	25.9	N	1999
1999	Area I	The restriction in Area I for a maximum of 100 traps per ground line was revoked January 1, 1999.	I	28	Y	1999
1999	Area J	Area J will open July 28 to December 31, 1999.	J	29.8	A	1999
1998	All	Requirement to haul gear within 14 days moved from regulations to licence conditions.	All	1	Y	1998
1998	Area A	Single trap gear required in Area A effective May 1, 1998.	A	1	Y	1998
1998	Area A	Traps fished in Area A must be marked with the registration number of the vessel fishing the traps.	A	1	Y	1998
1998	Area A	Area A closed to commercial fishing December 1 to December 31, 1998	A	1	N	1998
1998	Area B	110 mm escape holes required in all traps fished in Area B	B	3	Y	1998
1998	Ptn 3-12	Kinkolith half mile ribbon boundary between Nass Pt and Fort Pt redescribed after the definition of a ribbon boundary was challenged in court.	B	3.12	Y	1998
1998	Areas G & H	Setting and hauling crab traps permitted only between 1 hour before sunrise and 1hour after sunset.	G & H	11	Y	1998
1998	Ptn 19-3	Ogden Pt. Marine Reserve closed to crab fishing.	H	19.3	Y	1998
1998	Ptn 20-2	A portion of Port Renfrew closed to commercial fishing for Native and Sport Access.	E	20.2	Y	1998
1998	Areas 23 and 24	Areas 23 and 24 closed August to September due to domoic acid contamination	E	23	N	1998
1998	Ptn 23-8	Broken Group Islands of Pacific Rim National Park closed.	E	23.8	Y	1998
1998	Area I	Area I closed to commercial fishing January 1 to June 23 and November 30 to December 31, 1998.	I	28	Y	1998
1998	Areas I & J	Area D divided into 2 areas for the remainder of the three year licence term, Area I (Areas 28 and 29 excluding subareas 29-5 and 29-8) and Area J (Subarea 29-8). Vessels to select either Area I or Area J for 2 years.	I & J	28	Y	1998
1998	29-8	Area J closed to commercial fishing January 1 to July 24, 1998.	J	29.8	Y	1998
1997	All	Buoys used for crab traps must exceed 12 cm in diameter and a volume of 2.5 liters.	All	0	Y	1997
1997	All	Vessels required to select one area in which to fish for a period of 3 years.	All	0	Y	1997
1997	All	Rot cords may only be used on hinged lid traps with a total volume less than 400 litres. All other traps must be equipped with rot panels. (In response to traps with lids to heavy for a crab to escape from.)	All	0	Y	1997
1997	Area A and B	Rot panels must exceed a square 35 cm by 35 cm or a "V" 50 cm on each leg in Areas A and B to protect King Crab.	A & B	0	Y	1997
1997	Area A	Industry funded soft shell monitoring program in Area A during the June 1 to July 31 closure.	A	1	Y	1997
1997	Area A and 102-2, 105-2, 106-1	Area A soft shell closure to include offshore Subareas 102-2, 105-2 and 106-1. The soft shell closure was extended for June 1 to July 31 due to soft crab encountered in the monitoring program.	A	1	Y	1997
1997	101-10	McIntyre Bay closure description modified to exclude that portion of 101-10 south east of Rose Spit.	A	1.5	Y	1997
1997	Ptn 3-12, 3-18	Nass River estuary (3-12 north of Arrandale and south of Nass Pt.) and Iceberg Bay closed January 1 to October 1 to November 16 to December 31 for Native and Sport Access.	B	3.12	A	1997
1997	Area C	Area C was divided into Area G (Areas 11, 12, 13 and 15) and Area H (Areas 14, 16 to 19, and Subarea 29-5).	C	11	Y	1997
1997	Area D	Gear may be transported to the grounds with packers or barges on opening day only in Areas I & J.	D	28	Y	1997
1997	Area D	Area D was divided into 2 areas as a 1 year pilot within the three year licence term, Area I (Areas 28 and 29 excluding subareas 29-5 and 29-8) and Area J (Subarea 29-8).	D	28	Y	1997
1997	Area I	Area I closed to commercial fishing January 1 to June 23, 1997.	I	28	Y	1997
1997	29-8	Single trap gear only in Boundary Bay	J	29	Y	1997
1997	Area J	Area J closed to commercial fishing January 1 to July 31, 1997.	J	29.8	Y	1997
1996	All	Reports of crab exports required at least 24 hours prior to export.	All	0	Y	1996
1996	All	Barges, packers and mother ships not permitted in the crab fishery.	All	0	Y	1996
1996	All	Rot cords or rot panels required in sport traps. Rot panels to exceed 11 cm by 11 cm or 7 cm by 20 cm.	All	0	Y	1996
1996	Area A	All of Area A closed from June 1 to July 15 for soft shell.	A	1	Y	1996
1996	Ptn 1-5, 101-7, 101-10	McIntyre Bay closed from June 1 to September 21 for soft shell.	A	1.5	A	1996
1996	5-4 to 5-8	Kitkatla Inlet closed annually during Herring season March 10 to April 15.	B	5.4	Y	1996
1996	6-3, 6-4	Ursula Channel and Gardner Canal closed to commercial fishing January 1 to October 1 for Native and Sport Access. October 1 selected to align closure with others in Area B.	B	6.3	Y	1996
1995	All	Sport fishers required to have a BC Tidal Sport fishing licence to harvest crab.	All	0	Y	1995

Table 4.1.9. continued

Year	Areas or Subareas	Management action	Area	MA	Currently In Effect	Year
1995	1, 101, 102, 104, 105-1	Dogfish bank and McIntyre Bay closed to all fishing September 7 for Domoic Acid. Area reopened later that fall except 101-10 which remained closed until January 1996.	A	1	N	1995
1995	3-15	Portland Canal north of Green Islets closed all year for Sport Access. Portland Canal between Belle Bay and Green Islets closed January 1 to September 30 for Sport Access.	B	3.15	Y	1995
1995	4-12, 4-15	Buoys optional in the Skeena River estuary during salmon openings.	B	4.12	Y	1995
1995	Area D	300 trap limit in Area D, the Fraser River.	D	28	Y	1995
1994	All	Logbooks must be completed by midnight for the days fishing activity.	All	0	Y	1994
1994	All	All holding cages must be legibly marked with the registration number of the R licensed vessel used to harvest the crabs.	All	0	Y	1994
1994	All	Crab exports from B.C. that have not been through a federally registered processing plant must be reported.	All	0	Y	1994
1994	All	Electronic copies of harvest logs required for submission with paper copies.	All	0	Y	1994
1994	Area B	Area B closed from October 25 to November 8 for noncompliance with catch reporting requirements.	B	3	N	1994
1994	5-4 to 5-8	Kitkatla Inlet closed during Herring season March 15 to April 15, 1994.	B	5.4	A	1994
1994	Area 27	Area 27 closed for January 1994 due to domoic acid contamination	E	27	N	1994
1994	Area D	Setting and hauling crab traps permitted only between 1 hour before sunrise and 1hour after sunset.	D	28	Y	1994
1994	Area D	Fraser River area closed to commercial fishing January 1 to July 14, 1994 for soft shell.	D	28	A	1994
1993	All	Rot panel size reduced from 20 cm by 20 cm to 11 cm by 11 cm.	All	0	A	1993
1993	All	Issuance of tanner crab permits suspended by moratorium on new shellfish licences. (1992 was the last year with tanner crab permits.)	All	0	N	1993
1993	6-2	Coghlan Anchorage, Kitkiata Inlet and Kishkosh Inlet closed to commercial fishing for Native and Sport Access. Remainder of Douglas Channel opened.	B	6.2	Y	1993
1993	9-2, 9-3, 9-4, 9-6	Portions of Rivers Inlet closed to commercial fishing January 1 to September 30 for Native and Sport Access.	B	9	Y	1993
1993	23-10	Subarea 23-10 closed in October due to domoic acid contamination	E	23.1	N	1993
1993	Area 27	Area 27 closed from October to November1993 due to domoic acid contamination.	E	27	N	1993
1992	All	Buoys used for marking crab gear must remain floating and be adequately visible to pose no navigational hazard.	All	0	Y	1992
1992	All	Aboriginal harvesters required to be licenced or designated under Communal Aboriginal Fishing Licences issued to Native bands.	All	0	Y	1992
1992	All	Area licencing altered to 5 areas with all vessels allowed to fish the offshore area: Area F.	All	0	A	1992
1992	All	Weight of rot cord increased from #54 to #120 to reduce premature rotting.	All	0	Y	1992
1992	4-8	Big Bay closed seasonally for Native Access, January 1 to September 30.	B	4.8	Y	1992
1992	Ptn 4-9	Duncan Bay closed seasonally for Native Access, January 1 to September 30. (Portion of 4-9 inside Ryan Pt. and Chapman Pt.)	B	4.9	Y	1992
1992	Ptn 4-9	Metlakatla Area closed for Native and Sport Access. (Portion of 4-9 inside Observatory Pt. and Doolan Pt.)	B	4.9	Y	1992
1992	5-3, 5-10	Kitkatla village area closed to commercial fishing for Native Access.	B	5.3	Y	1992
1992	6-2	Douglas Channel closed to commercial fishing all year for Native and Sport Access	B	6.2	A	1992
1992	6-3, 6-4	Ursula Channel and Gardner Canal closed to commercial fishing January 1 to September 8 for Native and Sport Access. September 8 selected to ensure Sport Access during the long weekend.	B	6.3	A	1992
1992	7-11	Kynock Inlet closed all year for Native and Sport Access.	B	7	A	1992
1992	7-8, 7-10, 7-13 to 7-17	Areas in the vicinity of Klemtu and Bella Bella closed to commercial fishing January 1 to September 30, annually, for Native and Sport Access.	B	7	A	1992
1992	Area 27	Area 27 closed from August to October 1992 due to domoic acid contamination.	E	27	N	1992
1992	Area D	Fraser River area closed to commercial fishing January 1 to July 16, 1992 and 1993 for soft shell.	D	28	A	1992
1991	All	Licence limitation to 223 vessels.	All	0	Y	1991
1991	All	Weight of rot cord increased from #36 to #54.	All	0	A	1991
1991	All	Standard Buoy marking required.	All	0	Y	1991
1991	All	Non retention of female crab in the commercial fishery.	All	0	Y	1991
1991	Ptn 3-12, 3-18	Nass River estuary (3-12 north of Arrandale and south of Nass Pt.) and Iceberg Bay closed January 1 to September 30 for Native and Sport Access.	B	3.12	A	1991
1991	Ptn 19-5	Saanichton Bay closed to commercial fishing for Native and Sport Access	C	19	Y	1991
1991	24-4, 24-6, 24-8, 24-9, 24-11	Single trap gear and buoy color registration required in Tofino area for 125 trap limit.	E	24	Y	1991
1991	Area D	Fraser River area closed to commercial fishing January 1 to July 13 for soft shell.	D	28	A	1991
1990	All	Crab "R" category vessel based licence initiated.	All	0	Y	1990
1990	All	Harvest logs required in the commercial fishery.	All	0	Y	1990
1990	All	Annual area licencing initiated with 6 areas: A, B, C, D, E, & F.	All	0	A	1990
1990	All	100 mm escape holed required in crab traps.	All	0	Y	1990
1990	All	Rot cords or rot panels of #36 cotton twine required on all traps. Rot panels to exceed 20 cm by 20 cm.	All	0	A	1990
1990	All	All buoy lines required to be non floating.	All	0	Y	1990
1990	1-4	Naden Harbour closed May 1 to September 30 for soft shell.	A	1.4	A	1990
1990	Ptn 1-5, 101-7, 101-10	McIntyre Bay closed from July 1 to September 21 for soft shell. Masset bar (1-5 west of Skonum Pt.) removed from the closure and 101-7 and 101-10 added to the closure.	A	1.5	Y	1990
1990	Subareas 2-50 to 2-52, 2-80 to 2-84 and 2-93 to 2-100	Portions of the Queen Charlotte Islands removed from the commercial closure for Native and Sport Access.	A	2	Y	1990
1990	Area B	Area B closed January 1 to May 31, 1990 to protect soft shell crab.	B	3	N	1990
1990	Ptn 3-12	Kinkolith half mile ribbon boundary between Nass Pt and Fort Pt closed all year for Native and Sport Access.	B	3.12	A	1990
1990	Ptn 3-12, 3-18	Nass River estuary (3-12 north of Arrandale and south of Nass Pt.) and Iceberg Bay closed January 1 to August 31 and October 1 to December 31 for Native and Sport Access.	B	3.12	A	1990

Table 4.1.9. continued

Year	Areas or Subareas	Management action	Area	MA	Currently In Effect	Year
1990	6-2, 6-3, 6-4, 6-23	Douglas Channel, Ursula Channel, Gardner Canal and Khutze Inlet closed to commercial fishing January 1 to September 30 for soft shell and Native and Sport Access.	B	6.2	A	1990
1990	7-6, 7-10, 7-11, 7-13 to 7-17	Areas in the vicinity of Klemtu and Bella Bella closed to commercial fishing January 1 to September 30, annually, for Native and Sport Access.	B	7	A	1990
1990	8-7	Portion of Dean Channel closed to commercial fishing for Native and Sport Access.	B	8.7	Y	1990
1990	9-2, 9-3, 9-4, 9-10	Draney Inlet and portion of Rivers Inlet closed to commercial fishing from January 1 to September 30 for Native and Sport Access.	B	9	A	1990
1990	20-2	Port San Juan closed to commercial fishing July 1 to August 31 for Sport Access.	E	20	N	1990
1990	24-4, 24-6, 24-8, 24-9, 24-11	125 trap limit in Tofino area.	E	24	A	1990
1990	Area D	Fraser River area closed to commercial fishing January 1 to June 30 for soft shell.	D	28	A	1990
1989	1-5	McIntyre Bay soft shell closure July 10 to September 14, 1989.	A	1.5	A	1989
1989	2-1 to 2-4, 2-50 to 2-52, 2-63 to 2-67, 2-77, 2-80 to 2-84, and 2-93 to 2-100	Portions of the Queen Charlotte Islands closed for Native and Sport Access.	A	2	A	1989
1989	Areas 3 to 6	Areas 3 to 6 closed January 1 to June 1, 1989 for soft shell.	B	3	N	1989
1989	6-2	Douglas Channel closed to commercial fishing from April 30 to October 1 for Native and Sport Access	B	6.2	A	1989
1989	7-6, 7-10, 7-11, 7-13 to 7-17	Areas in the vicinity of Klemtu and Bella Bella closed to commercial fishing August 15 to October 1, 1989 for Native and Sport Access.	B	7	A	1989
1989	8-3, 8-13	Koeye River and Lower Burke Channel closed to commercial fishing for Native and Sport Access.	B	8.3	Y	1989
1989	9-2, 9-3, 9-4, 9-10	Draney Inlet and portion of Rivers Inlet closed to commercial fishing for Native and Sport Access.	B	9	A	1989
1989	19-6	Sidney Spit closed to commercial fishing for Native and Sport Access	C	19	Y	1989
1989	24-4, 24-6, 24-8, 24-9, 24-11	Tofino soft shell closure March 1 to June 25, 1989.	E	24	N	1989
1989	28, 29	Fraser River area closed to commercial fishing March 1 to June 30 for soft shell.	D	28	A	1989
1988	All	Permits first issued to fish tanner crab.	All	0	N	1988
1988	Areas 3 to 6	Prince Rupert District closed May 7 to June 15, 1988 for soft shell.	B	3	N	1988
1988	Area C	Gulf (Area C) closed March 15 to July 1 for soft shell.	C	11	N	1988
1987	Areas 3 to 6	Prince Rupert District soft shell closure May 10 to June 15.	B	3	N	1987
1987	24-4, 24-6, 24-8, 24-9, 24-11	Tofino soft shell closure May 7 to June 30.	E	24	N	1987
1987	28, 29	Fraser River area closed to commercial fishing March 16 to June 30 for soft shell.	D	28	A	1987
1985	29-3, 29-4, 29-6, 29-7, 29-9, 29-10	Crab traps fished in the area of Roberts Bank need not be marked with floating buoys during salmon net seasons.	I	29	Y	1985
1983	All	Regulation requiring crab traps be marked by surface buoys with the vessel registration number	All	0	Y	1983
1983	All	Crab gear limited to traps, dip nets and ring nets. (No sharp implements.)	All	0	Y	1983
1983	28, 29	Fraser River soft shell closure imposed. (timing varied)	D	28	A	1983
1980's	3-18	Iceberg Bay closed all year for Native Access.	B	3.1	A	1980
1980's	4-10, 4-11	Prince Rupert, Morse Basin closed for Sport and Native Access.	B	4.1	Y	1980
1980's	6-1	Kitimat Arm closed to commercial fishing for Native and Sport Access.	B	6.1	Y	1980
1980's	6-3, 6-4, 6-23	Ursula Channel, Gardner Canal and Khutze Inlet closed to commercial fishing August 1 to October 1 for Native and Sport Access.	B	6.3	A	1980
1980's	12-19	Nimpkish River estuary closed to commercial fishing for Native and Sport Access.	C	12	Y	1980
1980's	16-4	Pender Harbour closed to commercial fishing for Sport Access.	C	16	Y	1980
1980's	18-10	Fulford Harbour closed to commercial fishing for Sport Access.	C	18	Y	1980
1980's	23-1	Port Alberni closed to commercial fishing for Sport Access.	E	23	Y	1980
1980's	28-8, 28-10	False Creek and Burrard Inlet closed to commercial fishing for navigation purposes.	D	28	Y	1980
1978	All	Regulation requiring fishers to haul traps within fourteen consecutive fishing days.	All	0	A	1978
1978	All	Canada's fishing zone extended to 200 miles off shore.	All	0	Y	1978
1966	All	Crab first licenced under licence categories A, B, and N, followed by categories C, G, K, L, S and T.	All	0	N	1966
1964	All	Territorial Sea and Fishing Zones Act declared waters within three miles of the coast Canada's Territorial Sea and waters between 3 miles and 12 miles of the coast Canada's Fishing Zone.	All	0	A	1964
1958	1-5	McIntyre Bay soft shell closure July 10 to September 20.	A	1.5	A	1958
1957	All	Soft shell prohibition revoked due to the lack of a practicable criterion for shell hardness.	All	0	Y	1957
1957	All	Ovigerous female crab prohibition revoked due to redundancy for the protection of females, ovigerous or not, that rarely exceed the size limit.	All	0	Y	1957
1954	1-4	Naden Harbour closed May to September for soft shell.	A	1.4	A	1954
1954	1-4	Ring net gear only in Naden Harbour.	A	1.4	Y	1954
1926	All	Fishers prohibited from retaining soft shelled crab.	All	0	N	1926
1926	All	Fishers prohibited from retaining ovigerous female crab.	All	0	N	1926
1914-26	All	6.5 inch (165 mm) size limit initiated between 1914 and 1926.	All	0	Y	1914
1905-7	All	6.0 inch (153 mm) size limit.	All	0	N	1906
1885	All	First record of commercial fishing.	All	0	Y	1885

Table 4.1.10. Crab closures due to dioxins and furans.

LOCATION	DATE	Subareas	ACTION
Campbell River (Elk Falls)	23-Nov-89	13-5, Ptn 13-3	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in western part of Discovery Passage
Campbell River (Elk Falls)	29-Nov-90	13-4, 13-5, Ptn 13-3	Commercial closures and non-commercial consumption advisory on hepatopancreas extended to include the total area between Race and Mudge Points.
Campbell River (Elk Falls)	09-Aug-91	13-3, 13-4, Ptn 13-5	Commercial closure and non-commercial consumption advisory on hepatopancreas extended to north of Maud Island. Excludes Menzies Bay.
Campbell River (Elk Falls)	27-Aug-93	13-3, 13-4, 13-5, 13-6, Ptn 13-8, Ptn 13-14	Commercial closure and non-commercial consumption advisory on hepatopancreas extend north to Cape Mudge and west to Menzies Bay; Kanish Bay included; portion of Sutil Channel near Francisco Point added.
Campbell River (Elk Falls)	10-Feb-95	13-3 to 13-6, Ptn 13-7, Ptn 13-8, Ptn 13-9, Ptn 13-10, Ptn 13-14,	Commercial closure and non-commercial consumption advisory on hepatopancreas extended northwards to include Deepwater, Elk and Chonat bays
Campbell River (Elk Falls)	18-Apr-96	Ptn 13-9	Contamination closures lifted in Elk Bay. Commercial fishery re-opened January 1, 1997.
Campbell River (Elk Falls)	08-Sep-97	Ptn 13-12	Commercial closure and non-commercial consumption advisory on hepatopancreas for Owen Bay.
Crofton	23-Nov-89	17-5,17-6, 18-8	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in Stuart Channel and Cowichan Bay
Crofton	29-Nov-90	18-7	Commercial closure and non-commercial consumption advisory on hepatopancreas expanded to include Burgoyne Bay
Crofton	09-Aug-91	17-9, Ptn 17-6, Ptn 17-9	Commercial closure and non-commercial consumption advisory on hepatopancreas extended north to Ladysmith Harbour; Maple Bay added.
Crofton	14-Aug-95	18-8	Contamination closure lifted in Cowichan Bay (Area closed to commercial fishing for access by native and sport fishers)
Gold River	23-Nov-89	Ptn 25-1	Closure to all fishers: eastern Muchalat Inlet
Gold River	29-Nov-90	25-1, 25-2, 25-3	1989 closure to all fishers extended to include all of Muchalat Inlet
Gold River	27-Aug-93	Ptn 25-4	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed for Hisnit Inlet.
Gold River	10-Feb-95	25-1,25-2, 25-3	Muchalat Inlet re-opened to non-commercial with consumption advisory on hepatopancreas; commercial closure continues.
Gold River	14-Aug-95	Ptn 25-4	Contamination Closure lifted in Hisnit Inlet, commercial fishery reopened September 12, 1995.
Howe Sound	30-Nov-88		Closure to all fishers: northern and western areas of Howe Sound
Howe Sound	14-Jun-89		1988 closure to all fishers extended southward
Howe Sound	27-Aug-93	28-1, 28-2, 28-3, 28-4, 28-5, 29-1, Ptn 29-2, Ptn 29-3	Commercial closure and non-commercial consumption advisory on hepatopancreas extended south and west in Howe Sound
Howe Sound	10-Feb-95	28-4, 28-5	Northern area of Howe Sound re-opened to non-commercial fishers with a consumption advisory on hepatopancreas; commercial fishing closure/non-commercial hepatopancreas consumption advisory extended on western portion of Howe Sound to Reception Point.
Howe Sound	14-Aug-95	28-4, 28-5	Contamination closure lifted in upper Howe Sound (north of Anvil Island). Commercial fishery re-opened with following season (July 2, 1996).
Howe Sound	18-Apr-96	Ptn 28-1, 28-3	Area adjacent to Port Mellon pulp mill re-opened to non-commercial fishers with a consumption advisory on hepatopancreas; continued closure to commercial fishers.
Howe Sound		28-1 to 28-5	Commercial Closure/Non-commercial advisory on hepatopancreas imposed for remainder of Howe Sound
Kitimat	23-Nov-89	Ptn 6-1	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in Kitimat Arm.
Kitimat	29-Nov-90	Ptn 6-1	Commercial Closure and non-commercial consumption advisory on hepatopancreas extended to Coste Island.
Kitimat	18-Apr-96	Ptn 6-1	Contamination closure in Kitimat Arm lifted (area allocated to Native and sport fishers)
Nanaimo (Harmac and Crofton)	09-Aug-91	Ptn 17-4, Ptn 17-6, Ptn 17-7, 17-9, Ptn 17-13, 17-15, 17-16	Commercial closure and non-commercial consumption advisory on hepatopancreas extended Clark Bay to south of Link Island.
Nanaimo (Harmac and Crofton)	27-Aug-93	Ptn 17-4, Ptn 17-5, Ptn 17-6, Ptn 17-7, 17-9, Ptn 17-12, Ptn 17-13, 17-15, 17-16, Ptn 17-17	Commercial closure and non-commercial consumption advisory on hepatopancreas extended from Reynolds Point south to Kulleet Bay; area between Link Island and northern Valdes Island added.
Nanaimo (Harmac)	23-Nov-89	Ptn 17-13, 17-15, 17-16	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed in Northumberland Channel.
Nanaimo (Harmac)	29-Nov-90	Ptn 17-13, 17-15, 17-16	Commercial closure and non-commercial consumption advisory on hepatopancreas extended to north end of Newcastle and Gabriola islands.
Nanaimo (Harmac)	14-Aug-95	Ptn 17-12, Ptn 17-13, 17-15, 17-16, Ptn 17-17	Contamination closure lifted in entire area north of Reynolds Point-north Valdes Island to Newcastle Island-northern tip of Gabriola Island. Commercial fishery re-opened September 12, 1995.
Powell River	23-Nov-89	Ptn 15-1, Ptn 15-2	Closure to all fishers: Harwood Island to Powell River area.
Powell River	29-Nov-90	Ptn 15-1, 15-2	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed from Hernando Island to north Texada Island
Powell River	27-Aug-93	Ptn 15-1, 15-2	Commercial closure and non-commercial consumption advisory on hepatopancreas extended southeast to Myrtle Point
Powell River	10-Feb-95	Ptn 15-1, Ptn 15-2	Harwood Island-Powell River area (immediately adjacent to the pulp mill) re-opened to non-commercial fishers with a consumption advisory on hepatopancreas; continued commercial closure.
Powell River	14-Aug-95	Ptn 15-1, Ptn 15-2	Contamination closure lifted Powell River area from north end of Texada Island to Hernando Island, except area immediately adjacent to pulp mill (east of Harwood Island). Commercial fishery reopened September 12, 1995.
Prince Rupert	14-Jun-80	Ptn 4-11, Ptn 4-12	Commercial closure and consumption advisory on hepatopancreas imposed in Morse Basin and in vicinity of Coast Island
Prince Rupert	30-Nov-88	Ptn 4-11	Closure to all fishers: Wainwright Basin and Porpoise Harbour
Prince Rupert	27-Aug-93	Ptn 4-10	Commercial closure and non-commercial consumption advisory on hepatopancreas extended to west of Kaien Island
Prince Rupert	14-Aug-95	4-10, Ptn 4-11	Contamination closure lifted in area of Morse Basin northward to include Prince Rupert harbour area. Area allocated to Native and Sport crab fishing only.
Prince Rupert	18-Apr-96	Ptn 4-12	Contamination closure lifted in vicinity of Coast Island. Area re-opened to commercial crab fishing September 24, 1996 after consultation with commercial fishers.
Vancouver Hbr	01-May-92	28-10	Closure to all fishers: Burrard Inlet between Lion's Gate Bridge & Second Narrows Bridge
Vancouver Hbr	1991?	28-10	Contamination closure lifted. Fishery remains closed due to navigational hazard.
Victoria Hbr.	01-May-92	19-1	Commercial closure and non-commercial consumption advisory on hepatopancreas imposed from Macaulay Point to Chapman Point

4.2. Shrimp Trawl Fishery - 2000/01 - L. Convey, E. Wylie, R. Harbo and J. Boutillier

4.2.1. Introduction

Pacific Scientific Advice Review Committee ('PSARC'; formerly Pacific Stock Assessment Review Committee) Fishery Updates are prepared annually for each commercially harvested invertebrate species and provide a summary review of the commercial fishing season. This update refers to the 2000/01 fishing season for Canada's Pacific coast shrimp trawl fishery in British Columbia (B.C.), i.e. the harvest of shrimp by means of trawl gear.

Shrimp are harvested by two means in the Pacific region, trawl nets and traps. However, trawl gear is not permissible for recreational fishing. Refer to the *Pacific Region Integrated Fisheries Management Plan for Shrimp and Prawn by Trap* and the *PSARC Fishery Update - Shrimp and Prawn by Trap* or for more information on the commercial trap, or "prawn" fishery, First Nations fisheries, and recreational fisheries for shrimp and prawn. Integrated Fisheries Management Plans are available from the Fisheries and Oceans Canada Pacific Region web site http://www.pac.dfo-mpo.gc.ca.

Additional information on the shrimp trawl fishery is available on the Fisheries and Oceans Canada Pacific Region Shrimp Trawl web page (http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/shrimp/default.htm) and from the *2000/01 Integrated Fisheries Management Plan for Shrimp by* Trawl (available from the Fisheries and Oceans Canada Pacific Region web site at http://www.pac.dfo-mpo.gc.ca/ops/fm/mplans/mplans.htm), the *PSARC Fishery Update – Shrimp by Trawl Fishery 1997/98* and the Stock Status report for shrimp (available from the PSARC Secretariat at http://www.pac.dfo-mpo.gc.ca/sci/psarc/ResDocs/Invertebrate_99.htm).

PSARC Fishery Updates are available from the PSARC Secretariat (1-250-756-7208) on-line at http://www.pac.dfo-mpo.gc.ca/sci/psarc/ and by e-mail (psarc@pac.dfo-mpo.gc.ca).

4.2.2. Overview of the Fishery

There are seven *Pandalid* species harvested by trawl in BC (Butler 1980) and fisheries vary in complexity from single to multi-species fisheries for a variety of markets including machine-peeled, hand-peeled, frozen-at-sea, fresh and live shrimp. The majority of landings are a mix of pink shrimp (>90%) and sidestripe shrimp. Historically, humpback shrimp, coonstripe shrimp and spot prawns have been caught incidentally in small quantities and recently in more directed fisheries. There is an active trap fishery for prawns and retention in the commercial trawl fishery has been restricted to minor, incidental landings since 1990.

The shrimp fishery off the Pacific Coast developed in earnest in the 1960's with the use of trawl bottom gear. Few management and assessment programs were in place prior to the 1990's and the fishery was open year round without catch limits in most areas. Licences were limited in 1977, logbooks were implemented in 1987 and the first seasonal closure to protect egg-bearing shrimp for the offshore pink shrimp fishery off the West Coast of Vancouver Island was implemented in 1996.

In the mid-1990's there was a dramatic increase in effort and landings in the commercial shrimp trawl fishery. At the same time, Fisheries and Oceans Canada was moving to more precautionary management and risk averse principles and promoting selective fishing practices. Significant changes in management strategy were implemented in 1997 with the establishment of total allowable catches (TAC) for most areas, a seasonal opening for the offshore pink shrimp fishery and the development of industry-funded programs to monitor catches and a stock assessment program.

Management and assessment in this fishery are complicated by the diversity of shrimp stocks, multiple-species fisheries and varying types of fishing gear. The shrimp species occupy varying habitats and ecological niches and differ in size and value. Many of these fisheries are new or developing, with little information on which to assess the stocks. Although the stock status of BC shrimp is yet unknown, assessment programs have initiated a biologically based management strategy.

The foremost issue facing the shrimp trawl fishery today continues to be fleet over-capacity. Total allowable catches have been set to allow for conservation of the shrimp stocks and a sustainable fishery. Under the current management strategy, however, the TAC is largely precautionary and limited. Despite not all licences fishing, fishers nonetheless express concerns that this fishery currently does not meet their economic needs. Furthermore, the voluntary retirement of salmon licences have left many vessels with only a single commercial licence eligibility in shrimp trawl, placing greater effort and economic dependency on this fishery. Considerations for future management strategies to address the issue of economic viability are being considered in consultation with stakeholders.

4.2.3. Biological Synopsis

The following shrimp species are harvested commercially in the BC shrimp trawl fishery: smooth pink or ocean shrimp, *Pandalus jordani;* northern or spiny pink shrimp, *P. borealis eous;* sidestripe, *Pandalopsis dispar;* humpback, *Pandalus hypsinotus;* coonstripe, *P. danae;* flexed shrimp, *P. goniurus;* and spot prawns, *P. platyceros.*

The shrimp stocks off the west coast of Vancouver Island (WCVI) were at historically low levels in 1998-1999 as observed in the annual biomass survey index and in the fishery catch. Although shrimp biomass levels were low, an abundance of juveniles was observed on the Barkley Sound and Nootka grounds (Pacific Fishery Management Areas 123 and 125) in the annual survey in May 1999. This strong juvenile year class was present again during the May 2000 biomass survey in these two areas, contributing to an overall increase in the biomass estimate over previous years. In 2000, the biomass index off the Tofino grounds in Area 124 was still low at 60% of the long-term average, while the biomass index off the Nootka grounds in Area 125 was at the long-term average over the history of surveys (1973 - 2000). The shrimp biomass index in the southern grounds in Pacific Fishery Management Areas 23, 123, 121 was the highest observed, although there is only a short history of surveys in these areas (1996 - 2000; Area 23 was not included until 1998). Provided mortality is not high and fishing pressure is at a level to allow stocks to build, indications are for continued improvement to stock abundance for the WCVI through 2002. Offshore eulachon abundances also increased significantly in 2000, contributing to increased encounter rates, resulting in early gear restrictions and reduced shrimp catches. Based on the index of eulachon abundance and age structure in 2000 off the west coast of Vancouver Island, eulachon abundance offshore is expected to increase again in 2001, which may have significant impact on WCVI shrimp fishing opportunities.

In most other areas, sufficient history of stock information is not available to compare with long-term trends, however annual Survey Bulletins do indicate area-specific stock strengths and weaknesses and can provide an indication of a poor or strong year class for the future. The results of annual surveys are presented in Shrimp Survey Bulletins and are available from the Fisheries and Oceans Canada Shrimp Trawl web page http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/shrimp/default.htm.

The surveys undertaken last year indicate increasing pink shrimp abundance's for 2001 in Shrimp Management Area (SMA) Queen Charlotte Sound but declines around Calvert Island (SMA 9IN), and a decline in sidestripe shrimp in both these areas. Shrimp abundance's in 2000 were down in many Gulf areas (SMA's GSTE and 16 on the Sunshine Coast, SMA 18 off Sidney, and the mainland inlets of Queen Charlotte Strait in SMA 12IN). Increases in shrimp abundance's were observed around Victoria and Vancouver (SMA's 19, FR) and the more exposed areas of Queen Charlotte Strait (SMA 12OUT). A strong juvenile age class was observed in many of these areas (SMA's GSTE, 18, 19, 12IN, 12OUT and FR). These juveniles would spawn in 2002 provided mortalities are not high and may indicate some improvements to stock abundances in comparison to last year. Biomass surveys will be undertaken in these areas in 2001 and will provide an additional data point on which to base trends. Refer to Appendix 3.3.2. for a map of Shrimp Management Areas.

Stock Status Reports are presented and published annually by the PSARC and provide current status on Pacific invertebrate stocks. The Stock Status Report for shrimp can be found on the Fisheries and Oceans Canada Shrimp Trawl web page http://www.pac.dfo-mpo.gc.ca/ or http://www.pac.dfo-mpo.gc.ca/sci/psarc/.

4.2.4. Management Issues 2000/01

The following management issues were compiled for the 2000/01 Integrated Fisheries Management Plan for Shrimp by Trawl.

Overcapacity: The Department and members of the shrimp trawl industry have concerns that sufficient shrimp stocks may not exist to support the capacity of the fleet. The primary issue in developing management strategies for this fishery is the large fishing capacity of the fleet. Total allowable catches have been implemented to limit harvest and allow for conservation of the shrimp stocks and a sustainable fishery.

Lack of Stock Status Information: There is a lack of historic stock assessment information for this fishery. Development of biologically-based total allowable catches has been initiated in many areas and refinements to the stock assessment process are ongoing. Nevertheless, collection and refinement of stock information is a long-term process and remains a time constraint to industry expectations.

Multi-species Stocks: The geological, geographic and biological history of the BC coast has created many discrete stocks for many invertebrate species, including shrimp. The multitude of shrimp species and stocks involved in this fishery have resulted in complex management and assessment programs encompassing 36 Shrimp Management Areas and multi-species shrimp quotas in 31 areas.

Enforcement Capacity: Enforcement of this fishery is primarily opportunistic, as priorities within the region allow. There is concern that the on-grounds enforcement presence is not sufficient to support management objectives.

Selective and Responsible Fishing Practices: Standards for selective fishing will need to be developed and met by the target date of 2005, when all Pacific Fisheries are proposed to become selective. The incidental bycatch of eulachons is a concern and some First Nations have expressed concern about diminishing eulachon stocks.

Enhanced Fishery Values and Future Management Strategies: Fishers have expressed concern that the current value of the fishery does not meet the economic needs of the participants and request that consideration be given to management strategies to enhance fishery values.

4.2.5. Specific Management Objectives 2000/01

4.2.5.1. Conservation and Sustainability

- To limit harvest to a total allowable catch. In order to achieve the conservation and sustainable fishery objectives of the Department and to address the issue of the fishing capacity of the fleet, harvest is limited to a total allowable catch in most areas. The setting of total allowable catches follows a biological or precautionary approach.

- To insure the fishing season follows the egg-bearing period. This protects egg-bearing female shrimp from being impacted by the fishery twice.
- To monitor fishing effort and landings. An industry-funded Catch Monitoring Program, with hail and reporting requirements, tracks fishery landings in each Shrimp Management Area and provides for monitoring of total allowable catches. In addition, the stock assessment program collects information on fishing activity and effort through logbooks.
- To develop biological reference points for the West Coast of Vancouver Island. A precautionary approach is taken in the management of the seasonal opening for the offshore fishery off the West Coast of Vancouver Island (WCVI). Determination of biological reference points for the WCVI fishery will be considered by the Pacific Scientific Advice Review Committee in June 2000.
- To incorporate in-season stock assessment information in the management of the fishery. In-season adjustments to total allowable catches are based on biological and/or fishery assessment information and harvesting is set at fixed exploitation rates of 25% to 33% of the estimated biomass.
- To address issues of selective and responsible fishing practices. A Catch Sampling Program monitors and verifies fishery catches, composition of the catches and collects biological samples. Bycatch is controlled through time and area closures, monitoring of in-season bycatch action levels, retention limits for some species, and the mandatory use of selectivity devices.
- To involve enforcement staff in the fishery. Input from enforcement staff is required in the development of the IFMP and enforcement representatives will be invited and included in meetings of the Shrimp Trawl Sectoral Committee.

4.2.5.2. Domestic Considerations - Aboriginal Fishery

- The Department's Aboriginal Fisheries Strategy seeks to provide for the effective management and regulation of the Aboriginal fishery through negotiation of mutually acceptable and time-limited Fisheries Agreements. Even where an agreement cannot be concluded, Fisheries and Oceans Canada issues communal fishing licences to Aboriginal organizations allowing them to fish for food, social and ceremonial purposes.
- It is the policy of the Department to encourage increased Aboriginal communal participation in and integration with coastal commercial fisheries. Aboriginal involvement in the fishery is a shared goal between the Department and Aboriginal people. It is a means to stimulate Aboriginal economic development opportunities and develop fisheries expertise in Native communities, while serving as the basis for more co-operations between Aboriginal communities and the commercial fishery sectors. Aboriginal participation in the commercial shrimp by trawl fishery is being accommodated through the AFS Licence Retirement/Allocation Transfer Program. The Fisheries and Oceans Canada Aboriginal Fisheries Strategy Licence Retirement Transfer Program (ATP) retires existing commercial licence eligibilities

from fishers on a voluntary basis and re-issues these to eligible Aboriginal organizations as communal commercial licences.

- To address the issue of concern raised by some First Nations for the incidental bycatch of eulachon.

4.2.5.3. Domestic Considerations - Commercial Fishery

- To provide a management strategy for a sustainable fishery. Further discussion and consideration of the goals of stakeholders with respect to options for harvesting strategies are incorporated through the Shrimp Trawl Sectoral Committee. Options may include shorter term, variable harvest rates or longer term, steady harvest rates.
- Within a management strategy that provides for conservation of the resource and a sustainable fishery, to consider strategies brought forward by stakeholders with respect to an economically viable fishery.
- To involve the commercial sector in co-management of the fishery through the advisory process of the Sectoral Committee and a collaborative agreement with the Pacific Coast Shrimpers' Cooperative Association.
- To develop a three year IFMP.

4.2.5.4. Exploratory/Experimental

- Experimentation with selectivity devices that do not meet the specifications set out in the conditions of the licence are considered through application for a special amendment to the Conditions of Licence or Scientific Licence.
- Experimental fishing proposals and development of selective fishing techniques and standards are considered in consultation with the Selective Fishing Subcommittee of the Shrimp Trawl Sectoral Committee. Other proposals for research are directed through the Scientific Licence protocols with the Department.
- To allow for exploratory fishing in areas with a lack of catch history, arbitrary precautionary catch ceilings (generally 10 tonnes) have been assigned. A protocol for assessing shrimp stocks based on fishing information collected from these un-surveyed areas and further development of an exploratory protocol is under consideration.
- Experimental fisheries for the development of directed humpback fisheries are under consideration in consultation with both shrimp trawl and shrimp trap advisory committees.

4.2.6. Management Measures

The offshore pink shrimp (*P. jordani*) fishery off the West Coast of Vancouver Island is managed by setting a fishing season, or seasonal opening, the length and timing of which is dependent on the yearly stock status. For the inshore areas and the remaining offshore areas, the fishery is managed by limiting harvest to a total allowable catch (TAC) in each Shrimp Management Area (SMA). Preliminary TACs, or "initial catch ceilings", are set at the beginning of the season for each SMA and may be adjusted in-season with stock assessment information from in-season biomass surveys or other assessments. An industry-funded Catch Monitoring Program tracks landings against the TAC in each SMA.

Bycatch in this fishery is being addressed through time and area closures, mandatory use of selectivity devices in the trawls, retention limits for prawn and squid, non-retention of finfish, sampling of commercial catches through a catch sampling program, and in-season monitoring and setting of management 'action levels' for species of concern (eulachon).

4.2.7. Fishery Management Actions – 2000/01

4.2.7.1. Management Changes for the 2000/01 Shrimp Trawl Fishery

The following management changes were implemented for the 2000/01 shrimp trawl fishery:

- Licence period: shrimp trawl commercial fishery licences issued for 2000/01 were valid for the period April 16, 2000 to March 31, 2001. This change was made to correspond with the fiscal year and to facilitate collection of fees for co-management programs.
- Opening date: the 2000/01 shrimp trawl fishery opened coastwide June 1, 2000.
- WCVI: the seasonal opening for the West Coast of Vancouver Island offshore (SMAs 21OFF, 23OFF, 124OFF, 125OFF, 126OFF) opened June 1, 2000 for a five month fishery subject to an evaluation of shrimp stocks and eulachon bycatch by August 31, 2000. If required, a fishery closure was to be announced in-season. Further adjustments to the management plan resulting from the evaluation were to be developed in consultation with the Shrimp Trawl Sectoral Committee. All logbook information from the WCVI and Barkley Sound fisheries was required by August 1, 2000 for fishing up to that date to assist in the stock assessment.
- Southern Inside Waters: in support of a recommendation from the Shrimp Trawl Sectoral Committee for a one season trial period, the "Southern Inside Waters" (SMAs 23IN, 12IN, 14, GSTE, 16, 17, 18, 19, and FR), had two openings. The openings for Southern Inside Waters were June 1, 2000 for 60% of the catch ceiling and November 15, 2000 for the remainder of the annual quota.
- Mandatory Selectivity Devices: the shrimp trawl industry through the Shrimp Trawl Sectoral Committee with the support of the Pacific Coast Shrimpers' Cooperative Association and the Department recommended selectivity devices be mandatory as a condition of licence.
- Hailing by species: fishers were to provide the weight of each species of shrimp in the landing hail.
- Fishing areas hailed: to reduce the incidence of premature area closures, fishers were required to identify their primary fishing area in the fishing hail. If desired, fishers were permitted to identify one alternate fishing area.
- Transporting shrimp: a copy of the Shrimp Trawl Landing Record or a bill of landing (under B.C. Provincial requirements) had to be provided to accompany harvested shrimp in transit.
- Multiple day trip provision: the multiple day trip provision that allowed up to five consecutive day trips on one hail was terminated as it was unenforceable. A landing hail was required prior to offloading any shrimp.
- Sponge Reefs: the Shrimp Trawl Sectoral Committee, Pacific Coast Shrimpers' Cooperative Association and the Department asked fishers to avoid trawling in

areas of Hecate Strait and Queen Charlotte Sound with globally unique glass sponge (Hexactinellid) formations.

- Humpback and Coonstripe Fisheries: in general, the harvest of humpback and coonstripe shrimp is restricted to an incidental harvest. Directed humpback fisheries are under consideration. Input from the Shrimp Trawl Sectoral Committee will be sought in identifying areas for directed fisheries.
- Closures to fishing: Subareas 2-3 and 2-4 were closed for the 2000/01 season while directed fisheries were under consideration. It has been determined that the predominant species in this area is humpback shrimp.
- The Integrated Fishery Management Plan (IFMP) was introduced to provide a wider focus to the management of the species.

4.2.7.2. Initial Catch Ceilings

Catch ceilings, or annual quotas, for the 2000/01 season were in effect for the period April 16, 2000 to March 31, 2001. The initial catch ceilings for the 2000/01 season are listed in Table 4.2.5. Initial catch ceilings for most areas were the same as those set in 1998/99 and 1999/00, except for those areas in which biomass estimations were made in 2000. Biomass estimates were made by one of two methods:

- Fishery-independent biomass surveys in "index" areas.
- Extrapolations from index areas to adjacent non-surveyed areas.

For those areas that were surveyed i.e. "index areas", initial catch ceilings were forecast using growth and mortality estimates (the mean value between a high and a low natural mortality estimate were taken) applied to the survey biomass estimates from the previous year. The use of forecasts to set initial catch ceilings was undertaken for the first time in 1999. Forecasts have been based on a 33% exploitation rate in all areas except for SMA FR, as the rebuilding strategy for these shrimp stocks has utilised a 25% exploitation rate.

To account for sidestripe and/or coonstripe catch, species-specific forecasts were used to set catch ceilings in SMA's PRD, 18 and 19. The coonstripe catch ceiling for SMA 18 was adjusted slightly over the forecast in consideration of the annual quota in 2000.

A new analytical procedure was undertaken by the stock assessment program in 1999 to extrapolate biomass estimates for two areas adjacent to index areas; SMAs 14 and 3IN. The analysis compared similarities in species caught and historic CPUE (catch per unit of effort) between the surveyed and non-surveyed area. As these areas were not surveyed, there is insufficient data on which to calculate biological forecasts and initial catch ceilings were set to reflect the 1999 and 2000 assessments. In light of decreasing trends in stock abundance in SMA GSTE, and that the assessment of SMA 14 in relation to SMA GSTE had also indicated a declining trend, the initial catch ceiling for SMA 14 was set at the same value as in 1998/99 which followed a historic review and discussions with the industry. For SMA 3IN, there was a lack of historic catch data and in 1997 an arbitrary 10 t catch ceiling was initially assigned. In order to reflect the biomass estimates made for this area in 1999 and 2000, the initial catch ceiling for 2001 was set at an arbitrary level between 10 t and the 2000 biomass estimate.

4.2.7.3. In-season (2000/01) Management Actions Following Biomass Surveys

Initial catch ceilings were adjusted in-season if information from fishery independent biomass surveys indicated that the biomass of the area times a fixed exploitation rate resulted in a quota (or total allowable catch) for the area which was either less than or greater than the initial arbitrary level. Providing there was no indication of overfishing or low abundance of one cohort, the fixed exploitation rate was set at 33% of the total biomass (calculated as a sum of the survey landings and the fishery landings prior to the survey). Otherwise, the fixed exploitation rate was set at 25%.

In 2000/01, biomass surveys were undertaken in 15 Shrimp Management Areas, which includes the west coast of Vancouver Is., and biomass estimations were made in two SMAs by applying a method of extrapolating from surveyed areas to adjacent areas that were not surveyed. The annual quotas resulting from in-season surveys or stock assessments in comparison to the initial catch ceilings are provided in Table 4.2.5.

For details on the management actions in each Shrimp Management Area following a survey, refer to Appendix 4.2.1. Detailed information on each survey is provided through Shrimp Survey Bulletins available from the Fisheries and Oceans Canada Shrimp Trawl web site at http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/shrimp/default.htm. A summary of stock assessment surveys is presented in Table 4.2.8.

4.2.7.4. Management Actions on Bycatch

- Mandatory Selectivity Devices. The shrimp trawl industry through the Shrimp Trawl Sectoral Committee with the support of the Pacific Coast Shrimpers' Cooperative Association and the Department recommended selectivity devices be implemented for 2000 as a mandatory condition of licence.
- Special Management Areas. Queen Charlotte Sound (SMA QCSND) and Queen Charlotte Islands (SMA 2IN) were again designated 'special management areas' (as of 1998 and 1999, respectively) to facilitate arrangements for observer coverage in remote locations. Application must be made for amended conditions of licence in order to fish, which includes the requirement that arrangements for observer coverage be made. There are additional reporting requirements as well.
- Selective Fishing Studies and Bycatch Reduction Workshop. A comparative study of Selective Fishing gear was undertaken in 2000 by the Pacific Coast Shrimpers' Cooperative Association. In addition, selective fishing topics were discussed at a workshop held in February 2000. The Pacific Coast Shrimpers' Cooperative Association has been responsible for co-ordinating both projects with funding from the Fishery Management and Responsible Fishing Divisions of Fisheries and Oceans Canada, the shrimp trawl industry and Fisheries Renewal BC.
- Catch Sampling. A Catch Sampling program has been ongoing since 1997 to sample catches from the fishery, collect biological samples, monitor areas with specific concerns, quantify bycatch, and consider benefits of gear modifications. The Shrimp Trawl Sectoral Committee identified a Selective Fishing Sub-committee (1997) and Future Management Committee (1999) to work with the Department on issues related to development of selective and responsible fishing practices.
- Bycatch closures. Time and area closures are implemented to address bycatch concerns.
- Bycatch limits. Retention limits are set to limit and deter the bycatch of some

species for which there may be a bycatch concern.

- Bycatch Action Levels. In response to selective fishing initiatives and concerns for low eulachon returns to spawning rivers, 'bycatch action levels' for eulachon have been set since 1998 in areas where eulachon bycatches may occur and initiate increased management actions or fishery closures. These are the offshore areas of SMA Queen Charlotte Sound (QCSND) and the West Coast Vancouver Island (WCVI). Action levels have been monitored relative to an in-season estimate of incidental eulachon bycatch, determined from a ratio of eulachon to shrimp observed by on-board observers and expanded to the total shrimp landed in-season.

Eulachon

Queen Charlotte Sound was closed in 2000 due to concerns for poor eulachon returns to central coast rivers. Considerations to re-open Queen Charlotte Sound are dependent on the criteria established by Fisheries and Oceans Canada in discussion with the Shrimp Trawl Sectoral Committee and First Nations. These criteria will include improved returns of eulachons to central coast rivers, the index of offshore eulachon abundance, identifying an available shrimp quota and adopting a precautionary approach to eulachon by-catch. This was the second year in a row with little to no shrimp fishing activity in Queen Charlotte Sound, as there had been little activity in 1999 (refer to *PSARC Fishery Update – Shrimp by Trawl 1999/00*). The shrimp abundances surveyed in May indicated there was a significant loss in shrimp fishing opportunities (see 'North Coast Landings 2000/01').

The initial eulachon bycatch action level for the WCVI was maintained at the same level as 1999/00 (4-month season) and set at 24 t. This initial action level was reached by July 26, 2000 (Shrimp Management Area 23OFF closed July 14, 2000) and the WCVI fishery was closed after just 6 weeks of fishing activity while an assessment of bycatch and eulachon abundance and age class distribution from the May survey was undertaken. In recognition that the eulachon abundance index had increased over 6-fold due to an abundance of juvenile (1+ year old) eulachon, but that the abundance of 2+ year old eulachon had not increased significantly, a further biological reference point was set to limit the bycatch of 2+ year old eulachon at a level no greater than in 1999. Following the assessment and consultations with the Shrimp Trawl Sectoral Committee, the WCVI fishery re-opened Sept. 2 to Dec. 31, 2000 to the use of beam trawl only under amended conditions of licence. The closure date was adjusted from that set out in the management plan to account for the in-season disruptions to fishing activities.

Catch Sampling Program

The level of observer coverage was a concern this season, particularly early in the WCVI season with a lack of on-grounds coordination to arrange directly with Archipelago for observer coverage. Random sampling of vessels by zodiac was achieved in July, by which time high catch rates indicated that the initial action level would be reached. The industry expressed concerns that the sampling was biased, however, although sampling was undertaken over a relatively short time period due to the problems achieving coverage earlier in the season, there was a relatively good cross section of sampling undertaken from those vessels fishing. A better means to achieve sampling coverage should be developed for 2001/02.

4.2.8. Effort, Landings and Landed Value

4.2.8.1. Active vessels

The number of shrimp trawl licences issued annually has been limited since 1977 to 248. The number of active vessels (Table 4.2.1) in the shrimp trawl fishery ranged from 102 to 190 between 1982 to 1994, with unprecedented effort seen in 1995 and 1996 with 216 and 222 vessels active, respectively. Since the new management strategy was implemented in 1997, 181 to 187 vessels have actively fished (however the *1999 Shrimp Trawl Fishery Review* reports ~190 – 200 vessels active). This effort is at the high end of the range of historic effort prior to 1995. In 2000/01, there were 243 eligible commercial licences and 3 eligible communal commercial licences. Reports indicate that only 168 vessels were active, a decrease over previous seasons.

4.2.8.2. Landings – Historic

There are seven species of shrimp harvested commercially by trawl in BC. The majority of landings are a mix of "pink shrimp" (>90%, including smooth pink and northern pink) and the larger sidestripe shrimp.

Historically, landings in the shrimp trawl fishery fluctuated with annual shrimp abundances in offshore areas and participation in the fishery was highly dependent on shrimp abundances.

In the mid-1990's a rapid increase in effort and landings in the shrimp trawl fishery resulted from changes in the management of groundfish fisheries, poor salmon returns and retirement of salmon licences coinciding with a peak abundance of offshore pink shrimp (*P. jordani*) and high shrimp prices. The fishery also expanded with new and increased effort to harvest for a variety of markets.

Changes over 1994 to 1995 showed an increase in the number of active shrimp trawl vessels from 165 to 222, a doubling of effort from 7,311 to 14,324 fishing days, a doubling of shrimp landings from 3,192 tonnes to 6,777 tonnes and an increase in the annual landed value from $4.7 to $13.7 million (Southey *et al. in prep*).

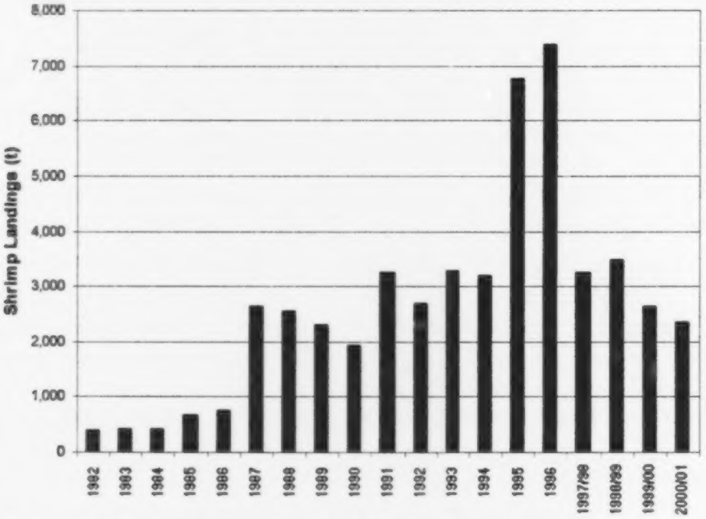

Figure 4.2.1. BC shrimp trawl landings (tonnes), 1982 to 2000/01. Area quotas were introduced in 1997.

The number of shrimp licensed vessels holding no other commercial licence eligibility, increased from six in 1995 to 67 in 1996 and again to 102 in 1999 following buy-back of salmon licences through the Voluntary Salmon Licence Retirement Program. Landings in the fishery peaked at over 7,300 tonnes in 1996. Significant changes in management strategy were implemented in 1997 to address conservation concerns associated with the rapid escalation in landings and effort through the establishment of precautionary catch ceilings (TAC) for most shrimp management areas. Since 1996, annual landings have returned to levels seen prior to 1995, ranging from ~2,000 to 3,000 tonnes.

4.2.8.3. Landings – 2000/01

Coastwide shrimp landings in 2000/01 were 2,352 t, which is lower than 2,646 t landed in 1999/00 (Table 4.2.1) and down from 3,493 t in 1998/99. Landings were reportedly affected coastwide by poor market conditions, early gear restrictions and in-season interruptions to WCVI fishing opportunities on reaching eulachon action levels, shutdown of the west coast processing plant and the closure of Queen Charlotte Sound.

Catch ceilings, annual quotas, survey dates, landings, and opening and closure dates for the 2000/01 season are provided in Table 4.2.5. Catch ceilings or annual quotas were in place for the period April 16, 2000 to March 31, 2001. Catch ceilings are adjusted in-season to annual quotas with results from in-season biomass estimations. Landings are those reported through the Shrimp Trawl Catch Monitoring Program (i.e. Landing Records; implemented in 1997). Catch information for most tables has been obtained from 'buyer' (part 2 of Landing Records i.e. processing plants, except in the case of public sales). Tables 4.2.2 and 4.2.3 provide landings by Pacific Fishery Management Area for comparison to previous years prior to development of Shrimp Management Areas. Table 4.2.4 provides monthly landings by individual Shrimp Management Area. Table 4.2.6 compares landings for each Shrimp Management Area between 1998/99 through 2000/01.

From the initial catch ceilings as detailed in the 2000/01 commercial harvest plan, the combined coastwide allowable catch, excluding the offshore west coast Vancouver Island (WCVI) season, was 1,593 t (3,511,825 lb.). This represented a slight increase from 1999/00 (1501.3 t) but a decrease from 1998/99 (1,680 t). Biomass estimations allocated an additional 930 t of available catch compared to 830.7 t (1999/00) and 871 t (1998/99) in the previous two seasons. However, as Queen Charlotte Sound did not open due to eulachon conservation concerns, this figure was substantially lower as it related to fishing opportunities. The total annual allowable catch for all areas, excluding the WCVI, was 2,006 t (2,939 t including Queen Charlotte Sound), which was a decrease over 1999/00 (2,332 t) and 1998/99 (2,473 t). The WCVI offshore (SMA's 21OFF, 23OFF, 124OFF, 125OFF, 126OFF) had landings in addition to these totals.

For 2000/01, the WCVI seasonal opening was 5 months, which provided for additional fishing opportunities over last year in light of improvements in shrimp stock abundances. However, although landings in 2000 were higher than 1999 due to improvements in shrimp abundances, the final landings for WCVI (1,389.6 t) did not reach expectations due to poor market conditions, early gear restrictions and in-season interruptions in fishing activity on reaching eulachon action levels and shutdown of the west coast processing plant.

Table 4.2.7 compares the harvest log landings to the 'adjusted' weight and 'estimated' weight from landing records. The landings obtained from harvest logs indicates good compliance in the submission of records, and compares well to the figure obtained from landing records, given that the time line for submission of landing records precedes that for the submission of harvest logs.

4.2.8.4. North Coast Landings 2000/01

Once again, Shrimp Management Area Prince Rupert (SMA PRD) had the highest landings in the north coast and the 2nd highest landings coast wide from any single shrimp management area with 334 t (572.9 t in 1999/00). With the closure to fishing in Queen Charlotte Sound, SMA 3IN was the second most important fishing area in the north coast (55 t) and has received interest for directed sidestripe fishing. Again, PRD remained active to the end of the season.

Queen Charlotte Sound (Areas 107, 7-1,7-26, 7-31,108, 8-1, 109, 110, 10-1, 10-2, 111, 11-1, 11-2, 130) had the highest landings of any single Shrimp Management Area in 1998/99 but had little fishing activity in 1999/00 and remained closed for the 2000/01 season with expressed conservation concerns for poor eulachon returns to central coast rivers. The May biomass survey estimated shrimp abundances at 883 t pink and 50 t sidestripe, which was a significant loss in fishing opportunity.

Fitzhugh Sound (SMA 9IN) had less effort compared to previous seasons with just 12.2 t pink shrimp and 9.2 t sidestripes landed this year (total shrimp was 47.8t in 1999/00 and 42.1 t in 1998/99). This area was originally assigned a 10 t ceiling in 1998/99, and quotas have been set annually since 1998 following surveys undertaken in conjunction with the survey in Queen Charlotte Sound. This area also sustains a moderate sidestripe fishery.

North coast landings (all areas) were 281.2 t, which represents a significant decrease over the previous two seasons (779 t and 1,228 t).

Exploratory 10 t and 25 t catch ceilings – North Coast

- In 1999, an in-season stock assessment (by "indexing") was made for the first time in SMA 3IN and an adjustment was made to the initial 10 t catch ceiling. As mentioned above, SMA 3IN was an important area to the north coast fishing opportunities this season. Final landings in 2000/01 were 55 t (63 t in 1999/00).
- Area 2 (SMA 2IN) was split from SMA QCI (Queen Charlotte Islands) in 1999, and in accordance with the setting of precautionary catch ceilings for inshore areas was given an arbitrary catch ceiling of 10 t. At the same time, Area 2 was designated as a 'special management area' with requirements for application for amended conditions of licence to fish and that arrangements for observer coverage be made prior to fishing. Subareas 2-3 and 2-4 were closed in 2000 under the Minister's direction that there be no directed fishing for humpback shrimp in new areas until assessment programs are in place. The 10 t catch ceiling was reached (10.7 t landed). SMA Queen Charlotte Islands (QCI; 25 t) was again not fished.
- Landings for SMA 5IN reached the catch ceiling again with 12.8 t (18.96 t in 1999/2000, which surpassed the catch ceiling, and 5.5 t in 1998/99). Following the extremely high catch rates in 1999, this area has been flagged as a next priority for stock assessment when time and funding provide.

- Landings in SMA 6IN reached the catch ceiling with 9.7 t landed (15.9 t in 1999/00 and 8.2 t in 1998/99). A report of significant shrimp biomass in Area 6 in 2000 was received.
- SMA 7IN has not been fished since Subarea 7-25 was split off and included with SMA QCSND in 1999.
- A number of 10 t areas on the north coast are generally not fished. As in 1998/99 and 1999/2000, SMA DXE (PFMA 1 and 101), and 5OFF (PFMA 5-11, 5-20, 5-22, 105) were not fished and only a small amount (0.2 t) was fished from SMA 10IN (PFMA 10-3 to 10-12) and SMA 8IN (0.3 t). Although SMA 6OFF attained the 25 t catch ceiling in 1998, it was virtually not fished in 1999 and not fished in 2000.

4.2.8.5. South Coast Landings 2000/01

In expectation of improved shrimp abundances off the west coast of Vancouver Island, the WCVI season was extended to 5 months from June 1 to October 31, 2000. The season was 4 months in 1999 and 6 months in 1998. Although shrimp biomass levels were low, an abundance of juveniles was observed on the Barkley Sound and Nootka grounds (Areas 123 and 125) in the annual survey in May 1999. This strong juvenile year class was present again during the May 2000 biomass survey, contributing to an overall increase in the shrimp biomass estimate.

Landings from the west coast offshore (WCVI) totalled 1,389.6 t compared to 1,092 t in 1999/00 (source: *1999 Shrimp Trawl Fishery Review*) and 1,111 t in 1998/99 (source: *1998 Shrimp Trawl Fishery Review*). As noted above, poor market conditions, early gear restrictions on reaching eulachon action levels and shutdown of the west coast processing plant is reflected in the landings. Offshore Barkley Sound (Shrimp Management Area 23OFF; Area 123 and Subareas 23-7 to 23-11) again had the highest landings of any shrimp management area in BC with 1,171.6 t (1,118.7 t in 1999/00). With the in-season closure to otter trawls, the larger vessels that generally tow otter trawl did not continue fishing activities and it is likely that the shrimp grounds further offshore and further from landing facilities received less activity. Landings from the Tofino grounds 93.2 t (SMA 124OFF; Area 124), Nootka grounds 75.4 t (SMA 125OFF; Area 125) and Swiftsure 49.4 t (SMA 121OFF; Area 121) were low in comparison. SMA 126OFF (Area 126) was not fished.

This year, an initial catch ceiling was set for the inshore Barkley Sound in SMA 23IN (Subareas 23-1 to 23-6) based on a biological forecast of the biomass from the previous season. An adjustment to the initial catch ceiling was made early in the season following the west coast survey in May. SMA 23IN was included with the 'Southern Inside Waters' and assigned split (2) openings. Final landings were significant (4th highest management area on the coast) and totalled 141 t compared to 65 t in previous years.

The Winter Harbour / Quatsino grounds, SMA 27OFF (Area 127, Subareas 27-1, 27-2, 27-4 to 27-6) achieved the catch ceiling with 47.9 t compared to 44.65 t in 1999/00.

Landings from the east coast of Vancouver Island (Areas 13 to 19) totalled 351.1 t, a decrease compared to last year (402.7 t in 1999/2000 and 351.3 t in 1998/99). Landings from the east coast of Vancouver Island were highest from SMA 14 at 124.0 t.

Landings from SMA 12IN (48.3 t pinks and coonstripes, 10.5 t sidestripes, 5.8 t humpbacks) showed obvious declines from previous seasons (e.g. 194.3 t pinks 4.4 t sidestripes, 3.5 t humpbacks in 1998/99) where high effort and good catch rates saw the fishery closed in a matter of days. In 2000/01, the annual quota was not attained. Indications are that the shrimp stocks in this area are highly variable, which should be a consideration in the development of stock assessment programs.

SMA 12OUT (Subareas 12-1 to 12-21, 12-24, 12-25) in Queen Charlotte Strait has been surveyed and assigned a quota since 1998. Landings were 10.3 t compared to 12.19 t in 1999.

Exploratory 10 t catch ceilings – South Coast

- SMA 27IN achieved the catch ceiling with 9.7t (4.75t in 1999/00 and 6.72t in 1998/99).
- Although SMA 11IN landed 11.1 t in 1998/99, only 0.05 t were landed in 1999/00 and only 0.3 t this year.
- SMA 25IN landed 7.5 t, slightly higher than in previous seasons.
- Of the six exploratory areas on the south coast, four inshore areas on the west coast of Vancouver Island with 10 t catch ceilings were either not fished, or were not productive enough in 1998, 1999 or 2000 to warrant effort and did not attain the catch ceiling. SMA 20 (no fishing), 24IN (2.4 t), 26IN (no fishing) were virtually not fished. These landings would indicate that vessels again found catches too poor to warrant further effort. At times, there have been allegations that there may be misreporting of landings from inshore areas on the west coast, (including SMA 27IN) that were actually caught elsewhere.

4.2.8.6. Fraser River Landings 2000/01

Shrimp Management Area FR (Areas 28, 29) was again an important fishing area for both landings and effort. A 25 % exploitation rate has been applied to stock assessments in this area as part of a stock rebuilding strategy following concerns expressed in 1996 (Boutillier and Joyce 1996). Nonetheless, this management area had the 3rd highest landings on the coast. Landings increased to 159 t compared to 108 t last year and 184 t in 1998/99.

4.2.8.7. Exploratory Areas - 10 t and 25 t Arbitrary Catch Ceilings

Shrimp Management Areas with little or no catch history have been assigned arbitrary exploratory catch ceilings since 1997. For 2000/01 14 of these areas were again assigned 10 t catch ceilings, 8 in the north (SMAs 10IN, 2IN, 5IN, 5OFF, 6IN, 7IN, 8IN and DXE) and 6 in the south (SMAs 11IN, 20, 24IN, 25IN, 26IN, 27IN), and 2 offshore areas all in the north were assigned 25 t catch ceilings (SMAs QCI, and 6OFF). The catch ceiling in SMA 3IN was increased for this season from 10 t to reflect the biomass estimations made in the previous year.

Priorities for stock assessments in exploratory areas are discussed with the Survey Subcommittee of the Shrimp Trawl Sectoral Committee. Based on landings (refer to landings discussions in the sections above) in the last two years and input from the Survey Subcommittee, the following exploratory areas have been identified as priority for stock assessments:

- A survey has been undertaken in SMA 12OUT since 1998.
- A survey has been undertaken in SMA 9IN since 1998.

- SMA 3IN has been prioritized to be included within the PRD survey, time permitting. In the event time does not permit, as has been accomplished since 2000, a biomass estimation is made by extrapolating from the PRD survey.
- SMA 5IN was identified as a next priority for assessment when time and funding permit.
- SMAs 6IN, 27OFF, and 27IN were also highlighted for assessment when time and funding permit.

4.2.8.8. Landed Value

Estimates of landed value for this fishery is complicated due to the number of different shrimp species harvested and the products produced. Furthermore, the landed value in the BC fishery is highly dependent on landings and ex-vessel prices in the dominant Washington, Oregon and California fisheries. Ex-vessel prices vary considerably due to seasonality of the fishery, competition with foreign product, and the difference in price by size, or species, of shrimp.

The annual landed value of the shrimp trawl fishery ranged from $2.6 million to $4.8 million between 1987 and 1994, reaching a peak of $13.7 million in 1995. Since the current management regime was introduced in 1997, the annual landed value has ranged between $5.3 and $5.8 million. The landed value in 1999/00 decreased from $5.8 million in 1998/99 and $5.7 million in 1999/00 to **$4.2 million** (source: 1999 *Shrimp Trawl Fishery Review*) which is a revision from the previous draft of the *PSARC Fishery Update 1999/00*. The initial calculation of landed value for **2000/01 from the in-season estimate of catch indicates another decrease to $4.1 million** (Table 4.2.7 based on 'estimated weight'). Overall, the shrimp trawl fishery has ranked 5th in landed value among B.C. shellfish fisheries.

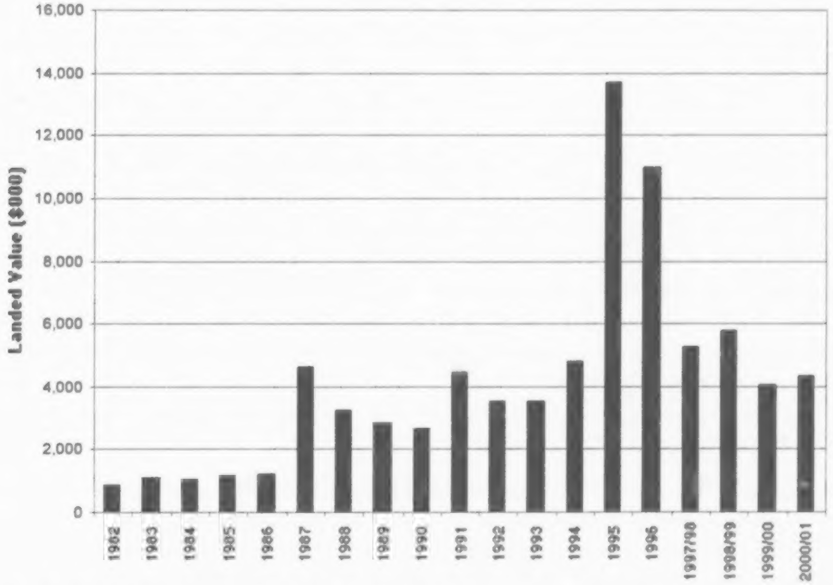

Figure 4.2.2. B.C. shrimp trawl fishery annual landed value ($000), 1982 to 2000/01. Area quotas were introduced in 1997.

4.2.8.9. Landings and Value by Shrimp Species

The landings by species of shrimp are given in Table 4.2.7. The landings for pink shrimp (all species) was 2,189 t which was a decrease from 2,376 t in 1999/00 and 3,055 t in 1998/99. The landings for sidestripe shrimp was 216 t compared to 273 t in 1999/00, which had seen an increase over 212 t in 1998/99. Area closures are affected on attaining either a species-specific, or area quota, as no means for directed fisheries are yet available. In 2000/01, the fishery in area 3IN closed on the pink shrimp ceiling, although additional sidestripe quota was available.

The majority of sidestripe landings come from SMA PRD, with significant landings also coming from SMA 3IN, SMAs 9IN and 12IN round out the top sidestripe landings. Sidestripes were also landed from other areas of the coast, SMAs 18 and 19.

Landings of humpbacks in 2000/01 have increased slightly again to 31.6 t from 29.8 t in 1999/00, which increased from 6.21 t in 1998/99. Shrimp Management Areas PRD, 12IN and 12OUT account for the highest humpback landings, although humpbacks were also landed from Areas 2IN, 3IN, GSTE, 14 and 17. (See below for discussion on directed fisheries and restrictions to incidental catch for humpback and coonstripe).

Landings of coonstripes increased to 51.6 t in 2000/01 compared to 45 t in 1999/00 and 43.0 t in 1998/99. Coonstripe have predominantly been landed from Areas 18 and 19.

The average price paid for pink shrimp (*P. borealis, P. jordani, and P. goniurus*) decreased from last season to $0.51/lb for a total landed value of $2.5 million. In 1998/99, the average price paid for pink shrimp was $0.65/lb. for a landed value of $4.4 million and in 1999/00 the average price paid was $0.75/lb. for a landed value of $3.9 million, with lower landings.

As smaller shrimp are generally not being sorted from the catch and are being landed and reported as 'pink' or 'generic' shrimp, the value reported for sidestripe, humpback and coonstripe shrimp is assumed to be the price paid for larger size shrimp. Estimates of value and price are not well recorded by fishers and buyers on landing records. Preliminary estimates follow. The average price paid for sidestripe shrimp (*P. dispar*) was $2.14/lb. compared to $3.21/lb. in 1999/00, $2.77/lb. in 1998/99, and $3.21/lb. in 1997/98. Total sidestripe value was $1.0 million. The price paid for humpback shrimp (*P. hypsinotus*) was $3.62/lb. compared to $3.36/lb. in 1999/2000, $1.60/lb. in 1998/99, and $1.71/lb. in 1997/98. Total humpback value was $253K. The average price paid for coonstripe shrimp (*P. danae*) was $2.96/lb. compared to $2.35/lb. in 1999/00, $1.04/lb. in 1998/99 and $1.21/lb. in 1997/98. Total landed value for coonstripes was $337K. As live coonstripes reportedly fetch over $4/lb. to the local market when fresh prawn are unavailable and live humpbacks were reportedly fetching $9/lb., the average price calculated for the year may indicate an inability to maximize market value. The incidental bycatch of prawns, contributed $6K to the fishery, $21K in 1999/2000, $4K in 1998/99, and $1K in 1997/98.

4.2.8.10. Multi-Species Management

Historically, shrimp have not been separated by species on the fish slips or log books and many fishers sorted by size rather than species (*PSARC Fishery Update,* Southey *et al.* 1998*)*. Efforts were made in 1997 to improve catch reporting by species. As identified in Shrimp Survey Bulletins in 1998, 1999 and 2000, many fishers continue to sort only larger shrimp from the 'pink shrimp' catch in landing records and on harvest logs, and the determination of catch composition and reporting by species still requires improvements. This likely occurs for all species in areas where a mix of species occurs. This is problematic, both in assigning the pre-survey fishery landings of 'generic' and/or 'pink' shrimp to the biomass estimates, and in the tracking of species-specific quotas. Selective fisheries and economic maximization for higher-valued species, will also require the ability to accurately track landings by species. Catch composition data collected by dockside and at-sea sampling should be compiled by area and considerations given to incorporate this data into landing or logbook data.

Initially, species-specific catch ceilings for 2000/01 were set only for SMAs PRD and 12IN (Table 4.2.5). Following biomass surveys, StAD examines the species composition from the survey catch, from harvest logs and from landing records. For areas in which recording of catch by species in landing records was expected to be inadequate in tracking species quotas (due to lack of sorting of small shrimp), aggregate species quotas were set as the catch composition was assumed to be reflected in the survey composition. Species-specific quotas were assigned in areas with directed fisheries and for which catch reporting on landing records was expected to better reflect species-specific directed fishing than would the catch composition estimate from the survey. Species-specific quotas were set following surveys in Shrimp Management Areas 3IN, PRD, 9IN, QCSND, 12IN, 18 and 19 (Table 4.2.5.).

There is interest within both the shrimp trap and shrimp trawl fleet to expand the exploitation of humpback shrimp. There is an active trap fishery for humpbacks in Prince Rupert harbour and Massett Inlet. Currently, the Departmental policy is that "any directed fishery for humpback shrimp in non-traditional areas or with new or modified trawl or trap gear will be subject to the Pacific Region Guidelines on New and Developing Invertebrate Fisheries" (letter from Mifflin, F.; Jan. 31, 1997). Subareas 2-3 and 2-4 were closed in 2000 under these guidelines. Sampling has shown the predominant species in these Subareas to be humpback shrimp.

Directed fishing for humpbacks became an issue late in the 2000/01 season with effort and landings being directed in SMA PRD in Area 4 for live humpback shrimp. The annual shrimp survey in SMA PRD has not focused on humpback areas, but has been directed towards the general fishery on pinks and sidestripes in Chatham Sound. As such, the annual quota for humpbacks has been small (1.6 t) and included within the quota for "all shrimp species other than sidestripes combined". While it is acknowledged that there are likely additional humpback stocks outside of the survey area, there is no information on which to base a quota for these stocks. Sampling and initial landings reports in-season indicated that the incidental humpback quota was surpassed. Sampling was undertaken and vessels were instructed to re-direct fishing away from localized humpback stocks.

In 1999, Canadian Stock Assessment Research Document 99/067 *Pandalus hypsinotus, Humpback Shrimp – A review of the Biology and a Recommended Assessment Framework for a Directed Fishery* was presented to the Pacific Scientific Advice Review Committee (PSARC) and outlines the initial framework under which to consider directed humpback fisheries.

A review of the biology and a recommended assessment framework for a directed fishery ("phase 0") for coonstripes has been requested. At this time, a quota is set and monitored for coonstripes following a survey in Areas 18 and 19 to ensure catches are within a biological reference point.

4.2.9. Stock Assessment Programs

Stock assessment and research activities are conducted by Fisheries and Oceans Canada, Science Branch, Stock Assessment Division, Shellfish Section. Research activities undertaken over the course of the 2000/01 season were as follows:

a) Fishery independent surveys of the offshore shrimp stocks off the west coast of Vancouver Island Areas 23, 121, 123, 124 and 125 completed in May, 2000
b) Fishery independent surveys of the offshore shrimp stocks of portions of areas in and adjacent to Queen Charlotte Sound (including Goose Island Gully, Pearl Rocks, Queens Sound) in June, 2000
c) Fishery independent surveys of Area 12 (Queen Charlotte Straits) in August, 2000.
d) Fishery independent surveys SMA FR in May, 2000.
e) Fishery independent surveys in the Gulf (SMAs 18, 19, GSTE) in September, 2000.
f) Fishery independent surveys in the north in SMA PRD and a concurrent stock assessment of SMA 3IN in September, 2000.
g) Stock assessment ("indexing") of shrimp stocks in Area 14 in November, 2000.
h) Processing and analysis of biological samples obtained from commercial catches by the catch sampling program (on-board observers and plant sampling), patrol and charter vessels.
i) Collected, corrected and compiled logbook and fishery independent data on shrimp trawl fisheries.
j) In-season assessment on abundance, age classes and bycatch of eulachon.
k) Canadian Stock Assessment Secretariat Research Document 2000/149 Reconstructing the offshore *Pandalus jordani* trawl fishery off the west coast of Vancouver Island and stimulating alternative management strategies.
l) Canadian Stock Assessment Secretariat Research Document 2000/168 Estimated Bycatch in the British Columbia Shrimp Trawl Fishery.
m) Post fishery survey of the stock in SMA Fraser River (2001) and a comparison of stratified vs. systematic surveys using bottom-typing information to set strata.

4.2.10. Enforcement Issues and Strategies

Efforts are being made to increase the current level of C&P representation at Shellfish Advisory (sectoral) meetings. In 2000, C&P representatives contributed to the development of the Integrated Fisheries Management Plan for 2001/02, by attending shrimp trawl sectoral meetings, providing suggestions for the development of management strategies and changes to conditions of licence and in development of the enforcement component for the IFMP.

The recommendation made in a previous update (Southey *et al.* 1998) was for Shellfish Fisheries Management and Conservation and Protection (C&P) to hold a familiarization program for Fishery Officers to help understand management plans, particularly with the increased complexity in the shrimp by trawl management plan. This was begun in 1999 in the south coast by the DFO South Coast Fisheries Coordinator travelling to local offices with information about this fishery. A summary of management changes in shrimp by trawl was given to all C&P staff that attended the Shrimp and Prawn by Trap C&P and Guardian meeting in April 1999. In addition, management representatives met with C&P to discuss shellfish fisheries management in March 2000. A summary from the meeting highlighted suggestions from C&P to simplify shrimp trawl openings and fishery notices.

In 2000/01 (fiscal) the Departmental Violations System (DVS) recorded that fishery officers expended 230 patrol hours and 374 office hours on the commercial shrimp trawl fishery. A total of 174 vessels, 239 persons, 10 vehicles, 46 gear and 117 sites were checked by C&P staff.

The result was 27 violations, eight charges, three charges pending, seven warnings, six violation tickets issued and three violations under native protocols from 49 investigations. Of the 27 violations (some offenders with multiple offences), there were seven licensing violations, four logbook violations, 11 prohibited species (including illegal sales), four closed time violations, and one theft of gear. This is an increase in the number of hours spent on enforcement in comparison to last year, fewer vessel and person checks, and fewer charges (although some cases are not complete). In 1999/00 there were five court imposed fines in the shrimp trawl fishery of $1,200.00 and one of $5,000.00. Court processes were ongoing when this update was published.

In the *1999 Shrimp Trawl Fishery Review* for the 1999/00 season, the catch monitoring program service bureau reported 151 occurrences to do with this fishery, indicating potential violations ranging from failure to complete catch reporting requirements (82), retention of prohibited species (two), to fishing during closed times (four). This indicates a significant increase in occurrences filed over the previous season (84). Almost 40% of these arose from processors/buyers submitting fish slips instead of landing records; this should be highlighted for remedial action in 2001/02. Another 40% of the occurrences arose from hail requirements not being met. Failure to make a landing hail was the major problem in both north and south coasts, particularly on the east coast of Vancouver Island. Landings to Steveston, Port Edward and French Creek account for most of these occurrences, due to the volume of fishing trips (including day trips) from these ports. In general, occurrences are followed up in-season provided Regional priorities allow and with notification to fishery officers from Fisheries Management that a suspected violation may have occurred.

4.2.11. Financial Responsibilities

A contribution agreement (class contribution of $128.4K) between the Department and the Pacific Coast Shrimpers' Cooperative Association (PCSCA) was reached in 1999 to provide co-management funds collected with licence fees to the PCSCA for administering the catch monitoring program, facilitator and research and development projects. The term of the agreement was for two years. This agreement has subsequently been amended to include the 2001/02 season. A means to collect co-management fees will need to be established prior to the 2001/02 season and is expected to be a significant issue.

4.2.12. Performance Review - Management Plan Evaluation Criteria

The fishery is evaluated annually through the following reviews:

a) Catch Monitoring Program report (post-season).
b) Pacific Scientific Advice Review Committee Fishery Update (post-season).
c) Catch Sampling Program report (post-season).
d) Shrimp Survey Bulletins (in-season).

Together, these reports summarize:

a) total allowable catches and fishery landings by area, and total fishery value;
b) in-season adjustments to total allowable catches;
c) post-season comments and recommendations from the Department, processors, harvesters and the Catch Monitoring Program Service Bureau;
d) enforcement and compliance violations related to the Catch Monitoring Program and encountered over the course of the program;
e) percentage of egg-bearing females in shrimp sampled;
f) species (shrimp) composition of the catches by area and age, and the size, age and sex of shrimp from in-season shrimp samples and surveys;
g) catch composition (percentage of target and non-target species) and bycatch estimates.

Management Plan Evaluation Criteria are published annually in the 2000/01 Integrated Fisheries Management Plan for Shrimp by Trawl available from the Fisheries and Oceans Canada web site at http://www.dfo-mpo.gc.ca.

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Table 4.2.1. Shrimp landings (tonnes) by trawl, effort and value as reported on sales slips (1982 to 1997) and Landing Records (1997 to 2001).

Year		Number of Eligible Licences	Number of Vessels with Landings	Fishing Effort (days)	Shrimp Landings (tonnes)	Total Landed Value ('000's $)	Whole Landed Value ($/kg)	$\bar{X}$ CPUE (tonnes/day)
1982		249	N/A	4,230	398	863	2.17	0.09
1983		249	120	8,076	411	1,095	2.66	0.05
1984		249	114	6,783	408	1,022	2.50	0.06
1985		249	102	6,337	678	1,180	1.74	0.11
1986		249	102	5,580	768	1,240	1.61	0.14
1987		249	165	9,027	2,643	4,609	1.74	0.29
1988		249	190	6,763	2,561	3,248	1.27	0.38
1989		249	174	6,982	2,299	2,838	1.23	0.33
1990		249	173	6,360	1,940	2,637	1.36	0.30
1991		249	185	7,564	3,265	4,430	1.36	0.43
1992		249	162	6,123	2,683	3,499	1.30	0.44
1993		249	158	6,139	3,283	3,499	1.07	0.53
1994		249	165	7,311	3,192	4,776	1.50	0.44
1995		249	216	14,331	6,778	13,663	2.02	0.47
1996		249	222	16,246	7,386	11,001	1.49	0.45
1997a	*	248	93	N/A	285	N/A	N/A	N/A
1997/98	**	248	181	N/A	3,255	5,262	1.62	N/A
1998/99	***	248	191	11,351	3,493	5,767	1.65	0.31
1999/00	***	249	198	11,180	2,646	4,167	1.72	0.24
2000/01	***	249	165	14,793	2,396	4,047	1.69	0.16

* 1997a data from Sales Slips (Jan 1/97 - Mar 31/97), Area Quotas were introduced in 1997 and the new season runs from April to March.

** 1997/98 data from Apr. 1/97 - Mar. 31/98. Sales Slips (Apr 1 - June 17) Landing Records (June 18 - Mar. 31/98)

*** Data from Landing Records (Apr 1 to Mar 31).

2000/2001 data is preliminary (total landings combined from area totals)

Table 4.2.2. Annual shrimp landings (tonnes), by trawl gear, for North Coast Management Areas, 1982 to 2000/01.

	NORTH COAST MANAGEMENT AREA											
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	Unknown	**Annual Landings**
1982	2.6	0.0	1.4	20.3	0.4	0.0	0.0	0.0	0.3	0.0		25.0
1983	1.9	#	1.7	11.4	#	1.2	0.0	0.0	#	#		19.7
1984	5.7	#	#	8.8	8.5	4.7	0.6	1.8	0.0	0.0		31.5
1985	3.0	#	2.5	15.8	11.9	#	0.0	#	#	0.0		34.3
1986	#	1.4	4.2	27.3	11.3	0.8	0.9	1.3	#	0.0		49.0
1987	5.9	1.7	2.6	19.7	6.9	7.6	#	1.1	#	#		47.5
1988	1.0	3.1	3.2	10.9	7.3	1.9	#	0.6	#	1.7		31.1
1989	3.0	#	0.6	29.7	5.2	3.7	2.5	6.4	3.7	7.3		63.5
1990	2.5	#	4.0	91.2	8.2	24.2	0.5	1.2	0.1	0.3		132.6
1991	3.6	7.7	2.4	75.8	7.4	6.0	0.7	0.8	2.2	2.6		109.2
1992	#	#	3.2	52.8	12.5	#	3.7	4.2	3.7	#		91.5
1993	2.9	#	8.2	46.9	7.3	1.7	2.1	3.1	0.2	#		77.3
1994	22.5	#	#	61.1	6.6	6.2	0.7	0.3	#	0.2		101.5
Average 1982-1994	4.5	1.5	2.7	36.3	7.4	4.5	0.9	1.6	1.3	1.9		62.6
1995	0.8	4.8	9.0	198.4	18.1	23.0	0.8	11.8	11.9	2.1		280.5
1996	10.6	0.7	16.7	507.1	51.7	27.4	251.1	911.4	12.6	32.0		1821.3
1997a*	0.0	0.0	8.3	23.9	7.1	0.0	0.3	0.0	0.0	0.0		39.6
1997/98**	0.2	0.4	31.0	136.2	41.0	11.2	144.1	414.1	16.9	85.6		880.9
1998/99***	0.0	19.2	9.1	227.7	19.8	28.8	333.7	459.5	96.1	30.4	213.4	1437.9
1999/2000***	0.0	15.0	93.3	441.2	57.6	14.8	5.8	#	67.4	10.7	32.8	745.0
2000/2001	0.0	#	68.5	213.5	46.1	9.3	2.2	#	18.3	#	6.7	393.0

* 1997a data from Sales Slips (Jan 1/97 - Mar 31/97), Area quotas were introduced and the new fishing year runs April to March.

** 1997/98 data from Apr. 1/97 - Mar. 31/98. Sales Slips (Apr 1 - June 17) Landing Records (June 18 - Mar. 31/98)

*** 1998/99 data from Apr.1/98 to Mar. 31/99 all from Landing Records.

# **Landings do not meet confidentiality requirements.**

Table 4.2.3. Annual shrimp landings (tonnes) by South Coast Management Areas, 1982 to 1999/2001.

	SOUTH COAST MANAGEMENT AREAS												
	East Coast Vancouver Island												East Coast Landings (t)
Year	11	12	13	14	15	16	17	18	19	28	29	Unknown	
1982	0.0	0.4	0.0	18.8	0.0	6.4	20.5	6.1	0.1	53.6	90.6		196.5
1983	#	1.7	#	26.2	#	13.3	70.3	13.1	#	28.1	171.5		324.8
1984	0.0	1.5	#	27.7	0.0	1.3	90.2	4.6	0.7	80.3	120.1		327.0
1985	0.0	2.0	0.4	32.6	#	1.2	60.4	5.3	0.8	60.7	92.9		256.5
1986	#	12.3	3.1	39.7	2.4	4.0	42.1	4.2	1.4	74.8	51.7		235.9
1987	1.1	6.0	1.2	38.5	1.2	7.7	23.7	12.7	#	83.5	78.3		255.4
1988	0.0	6.2	#	49.6	#	#	33.1	8.1	3.2	53.6	114.3		270.9
1989	0.4	3.0	1.3	35.5	13.9	1.7	36.0	8.5	4.5	42.2	91.2		238.1
1990	0.2	12.0	1.9	51.7	#	2.7	15.2	4.5	0.8	13.9	61.4		165.6
1991	0.1	12.4	0.0	77.4	2.3	#	37.0	10.9	0.4	54.6	67.0		262.8
1992	#	1.6	24.3	109.7	46.2	#	39.4	7.4	#	50.5	91.1		371.8
1993	#	2.7	1.1	116.4	42.9	1.5	22.9	5.3	0.1	57.3	86.7		338.9
1994[1]	0.2	0.8	#	78.0	65.7	2.2	15.4	2.5	#	24.4	43.4		235.0
Average 1982-1994	0.2	4.8	2.8	54.1	13.7	3.4	38.9	7.2	1.1	52.1	89.2		267.6
1995	16.5	71.9	12.3	35.3	52.0	1.9	20.7	14.5	1.7	69.0	85.3		381.2
1996	55.4	546.9	2.5	120.2	69.3	16.0	23.8	195.8	23.1	64.9	283.8		1,401.7
1997a*	1.9	29.7	1.4	32.4	21.6	2.2	0.0	76.0	23.1	0.1	0.1		188.5
1997/98**	43.7	163.8	25.8	93.1	75.4	21.2	16.3	115.1	32.0	61.2	69.7		717.4
1998/99***	11.5	188.5	17.8	90.7	156.5	32.6	11.8	76.6	19.2	51.5	130.9	17.9	805.6
1999/00***	#	110.1	8.4	158.5	68.3	39.6	8.2	52.2	39.8	29.2	80.4	0.9	595.7
2000/01	#	74.4	6.8	114.2	79.2	31.2	8.8	30.4	61.4	30.2	124.9	2.7	565.7

	West Coast Vancouver Island									Total	
Year	20	21	22	23	24	25	26	27	Unknown	West Coast Landings (t)	South Coast Landings (t)
1982	0.5	0.0	0.0	34.5	123.0	0.0	0.0	0.0		158.0	354.5
1983	17.2	10.9	0.0	36.7	0.0	0.0	0.0	#		66.6	391.4
1984	7.0	0.0	0.0	40.9	#	#	0.0	#		50.0	377.1
1985	4.8	#	0.0	304.6	73.1	#	0.0	0.6		387.5	644.0
1986	3.7	#	0.0	288.5	190.4	#	0.0	0.7		483.3	719.2
1987	6.4	0.0	0.0	281.3	2,049.6	1.8	#	0.5		2,340.8	2,596.2
1988	4.7	0.0	0.0	276.9	1,972.0	#	0.0	3.0		2,258.8	2,529.7
1989	13.1	0.0	0.0	310.1	1,660.4	8.9	#	4.2		1,997.1	2,235.2
1990	4.9	#	0.0	302.1	1,330.2	#	0.0	#		1,641.4	1,807.0
1991	9.5	0.0	0.0	989.9	1,656.8	204.2	0.0	30.3		2,892.5	3,155.3
1992	2.6	#	#	138.3	1,009.5	989.9	#	67.1		2,219.7	2,591.5
1993	2.3	0.0	#	293.0	895.9	1,650.9	#	1.7		2,886.5	3,205.4
1994	5.8	#	#	528.9	1,424.3	889.4	#	#		2,856.6	3,091.7
Average 1982-1994	6.3	1.2	2.1	294.1	952.9	288.7	1.3	8.6		1,555.3	1,822.9
1995	8.5	85.6	0.0	4,155.8	1,413.5	870.8	12.1	37.1		6,583.4	6,964.6
1996	3.2	48.0	3.3	3,205.9	529.2	476.4	7.3	118.0		4,391.3	5,793.0
1997a*	0.0	0.0	0.0	3.9	0.0	48.3	0.0	4.7		56.9	245.4
1997/98**	0.0	33.4	0.0	1,105.5	466.5	48.6	3.1	0.0		1,657.1	2,374.5
1998/99***	0.0	0.0	0.0	936.0	32.3	190.8	11.9	56.0	20.5	1,247.6	2,053.2
1999/2000***	0.1	0.0	0.0	1,090.9	8.5	47.1	#	37.7	1.8	1,187.6	1,783.3
2000/2001	0.0	46.9	0.0	1,164.9	96.5	61.6	0.0	#	59.4	1,438.9	2,004.7

Notes: 1. Areas 28 & 29, 1994 catches have been corrected to reflect catch by area based on logbook data.

* 1997a data from Sales Slips (Jan 1/97 - Mar 31/97), Area quotas were introduced and the new fishing year runs April to March.

** 1997/98 data from Apr. 1/97 - Mar. 31/98. Sales Slips (Apr 1 - June 17) Landing Records (June 18 - Mar. 31/98)

*** 1998 onward all data from Apr.1 to Mar. 31 all from Landing Records.

# **Landings do not meet confidentiality requirements.**

Table 4.2.4. Summary of trawl landings (tonnes) for Shrimp Management Areas and month in 2000/01, as reported on Landing Records.

NORTH COAST MANAGEMENT AREAS

Month	DXE	QCI	2IN	3IN	PRD	5IN	5OFF	6IN	6OFF	7IN	8IN	9IN	10IN	QCSND
Apr	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June	-	-	-	8.3	4.9	2.1	-	4.1	-	-	-	-	-	-
July	-	-	-	17.9	16.7	3.1	-	3.8	-	-	-	-	-	-
Aug	-	-	-	3.4	44.6	3.3	-	1.4	-	#	-	3.8	#	-
Sept	-	-	-	11.0	21.6	3.0	-	-	-	-	-	4.3	-	-
Oct	-	-	-	6.3	22.0	-	-	-	-	-	#	1.3	-	-
Nov	-	-	-	-	33.3	-	-	-	-	-	-	-	-	-
Dec	-	-	-	-	20.4	-	-	-	-	-	-	-	-	-
Jan	-	-	-	-	19.5	-	-	-	-	-	-	-	-	-
Feb	-	-	#	-	32.8	-	-	-	-	-	-	4.6	-	-
Mar	-	-	-	-	59.9	-	-	-	-	0.1	-	0.4	-	-
Apr *	-	-	-	1.9	14.6	-	-	-	-	1.6	-	5.6	-	-
Unk**	-	-	-	8.5	21.7	0.9	-	-	-	0.2	-	1.3	-	-
Area Total	-	-	#	57	312	12	-	9	-	#	#	21	#	-

TOTALS

North Coast	South Coast	Coast Wide	ECVI	WCVI	WCVI Off
-	-	-	-	-	-
-	-	-	-	-	-
19.4	606.0	625.4	139.4	466.6	433.8
41.5	460.6	502.1	63.0	397.6	310.5
57.3	82.0	139.3	40.1	41.8	1.1
40.0	378.6	418.6	3.0	375.6	342.3
29.8	110.3	140.1	3.0	107.3	106.8
33.3	91.3	124.6	80.9	10.5	7.4
20.4	82.9	103.3	80.3	2.7	-
19.5	64.7	84.2	51.6	13.1	-
46.0	73.2	119.2	52.5	20.6	-
60.5	47.8	108.3	45.7	2.1	-
23.7	4.4	28.1	4.4	-	-
32.5	35.3	67.8	12.3	22.9	1.1
424	2,037	2,461	576	1,461	1,203

SOUTH COAST MANAGEMENT AREAS

	East Coast Vancouver Island										West Coast Vancouver Island											
Month	11IN	12IN	12OUT	GSTE	14	16	17	18	19	FR	20	21OFF	23IN	23OFF	24IN	124OFF	25IN	125OFF	26IN	126OFF	27IN	27OFF
Apr	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
June	-	18.3	0.4	13.4	19.8	6.8	4.1	20.7	26.8	29.2	-	-	32.6	378.0	-	16.6	#	39.2	-	-	-	-
July	-	9.5	-	13.2	18.8	12.3	-	9.1	0.1	-	-	46.9	37.7	219.5	0.1	77.1	2.4	13.9	-	-	-	-
Aug	-	1.9	0.4	-	37.6	#	-	-	-	-	-	-	18.1	1.1	0.1	-	2.6	-	-	-	-	19.9
Sept	-	1.3	1.3	-	0.3	-	-	-	-	-	-	-	-	340.8	0.5	#	2.2	0.9	-	-	#	22.9
Oct	-	2.1	0.9	-	-	-	-	-	-	-	-	-	-	106.8	0.3	-	0.2	-	-	-	-	-
Nov	-	5.0	-	9.5	18.0	2.2	3.6	-	17.5	25.1	-	-	3.0	7.4	-	-	-	-	-	-	-	-
Dec	-	4.7	0.2	13.0	19.4	2.9	-	0.2	8.7	31.2	-	-	2.7	-	-	-	-	-	-	-	-	-
Jan	-	1.4	4.4	19.7	-	0.8	1.1	0.5	8.3	15.4	-	-	12.0	-	#	-	-	-	-	-	-	-
Feb	#	4.8	3.8	15.1	-	2.5	-	-	-	25.7	-	-	20.6	-	-	-	-	-	-	-	-	-
Mar	-	8.1	3.2	2.8	-	4.3	-	-	-	27.2	-	-	2.1	-	-	-	-	-	-	-	-	-
Apr*	-	2.8	#	0.3	-	-	-	-	-	1.3	-	-	-	-	-	-	-	-	-	-	-	-
Unk**		0.5	0.3	2.5	1.9	0.3	0.1	0.0	3.3	3.4	-	-	12.3	1.1	-	-	-	-	-	-	#	7.7
Area Total	#	60	#	90	116	#	9	30	65	159	-	47	141	1,055	#	#	#	54	-	-	#	51

Apr * These are landings that were fished in Mar 01 but landed in Apr. 01
Unk** Unknown date or missing buyer information.

Table 4.2.5. Shrimp Trawl catch ceilings, quotas and opening/ closure dates, 2000/ 2001.

Shrimp Management Area (SMA)	Subareas	Initial Catch Ceiling (lbs)	Opening Date	Closure Date	Landings (lbs)	Survey Date	Adjusted Quota (lbs) from survey	Re-Open Date	Re-Close Date	Re-Open Landings	Final Area Quota	Total (lbs)
DXE	1, 101	22,050	01-Jun	31-Mar	-						22,050	0
QCI	102, 142	55,155	01-Jun	31-Mar	-						55,155	0
2IN	2	22,050	01-Jun	30-Jan	#						22,050	#
3IN all but sides	3-5 to 3-16	66,140	01-Jun	25-Oct	56,604	July	57,099				66,140	56,604
3IN sidestripes	3-5 to 3-16	44,090	01-Jun	25-Oct	51,189		91,710				44,090	51,189
PRD all except	3-1 to 3-4, 103, 4-1 to 4-16, 104, 5-1, 5-2, 5-23	1,022,940	01-Jun	26-Mar	409,084	July	505,000				505,000	409,084
PRDsides		390,220	01-Jun	26-Mar	234,485	July	334,000				334,000	234,485
5IN	5-3 to 5-10, 5-12 to 5-19, 5-21, 5-24	22,050	01-Jun	07-Sep	25,328						22,050	25,328
5OFF	5-11, 5-20, 5-22, 105	22,050	01-Jun	31-Mar	-						22,050	0
6IN	6-1 to 6-8, 6-10 to 6-12, 6-14 to 6-16, 6-18 to 6-28	22,050	01-Jun	18-Jul	20,495						22,050	20,495
6OFF	6-9, 6-13, 6-17, 106	55,155	01-Jun	31-Mar	-						55,155	0
7IN	7-2 to 7-25, 7-27 to 7-30	22,050	01-Jun	31-Mar	4,951						22,050	4,951
8IN	8-2 to 8-16	22,050	01-Jun	31-Mar	#						22,050	#
9IN	9-1 to 9-12	132,300	01-Jun	31-Mar		May					N/A	N/A
9IN pinks					26,957		52,900				52,900	26,957
9IN sides					20,213		30,864				30,864	20,213
10IN	10-3 to 10-12	22,020	01-Jun	31-Mar	#						22,020	#
QCSND	107, 7-1, 7-28, 7-31, 108, 8-1, 109, 110, 10-1, 10-2, 111, 11-1, 11-2, 130	330,700	Did not open due to eulachon conservation concerns		-	May					N/A	N/A
QCSND pinks					-		1,946,670			-	1,946,670	0
QCSND Sides					-		110,250			-	110,250	0
11IN	11-3 to 11-10	22,050	01-Jun	31-Mar	1,338						22,050	1,338
12OUT	12-1 to 12-21, 12-24 and 12-25	22,050	01-Jun	31-Mar	32,501	August	76,100				76,080	32,501
20	20	22,050	01-Jun	31-Mar	-						22,050	0
21OFF	21, 121	N/A	01-Jun	19-Jan	103,318	May					N/A	103,318
23OFF	23-7 to 23-11, 123	N/A	01-Jun	19-Jan	2,322,760	May					N/A	2,322,760
24IN	24	22,050	01-Jun	31-Mar	4,539						22,050	4,539
124OFF	124	N/A	01-Jun	19-Jan	207,921	May					N/A	207,921
25IN	25	22,050	01-Jun	31-Mar	16,583						22,050	16,583
125OFF	125	N/A	01-Jun	19-Jan	119,119	May					N/A	119,119
26IN	26	22,050	01-Jun	31-Mar	-						22,050	0
126OFF	126	N/A	01-Jun	19-Jan	-						N/A	0
27IN	27-3, 27-7 to 27-11	22,050	01-Jun	19-Jan	17,043						22,050	17,043
27OFF	27-1, 27-2, 27-4 to 27-6, 127	110,230	01-Jun	19-Jan	94,473						110,230	94,473
											-	0
Southern Inside Waters 1											-	0
12IN	12-22, 12-23, 12-28 to 12-[illegible]	76,368	01-Jun	*	N/A	August		*	31-Mar			
12IN Pink & Coon					53,259		178,400			37,616	178,400	90,875
12 IN Sides					16,238		28,200			11,576	28,200	27,814
12 IN Humpbacks					3,201		20,300			9,684	20,300	12,885
GSTE	13, 15	99,200	01-Jun	21-Jul	58,831	Sept	216,400	16-Nov	31-Mar	133,355	216,400	192,186
14	14	276,522	01-Jun	22-Aug	168,657			15-Nov	15-Dec	83,133	276,522	251,790
16	16	65,000	01-Jun	30-Jul	42,680	Sept	80,400	15-Nov	31-Mar	27,999	80,400	70,679
17	17	17,640	01-Jun	10-Jun	9,106			15-Nov	23-Nov	10,390	17,640	19,496
18	18	121,255	01-Jun	23-Jul	N/A	Sept		**				
18 Pinks	18				51,712		103,100				103,100	51,712
18 Coons	18				8,983		16,000				16,000	8,983
18 Sides	18				6,325		10,100				10,100	6,325
19	19	60,400	01-Jun	28-Jun	N/A	Sept		15-Nov	19-Jan			
19 Pinks	19				44,421		434,700			14,573	434,700	58,994
19 Coons	19				13,160		85,200			60,093	85,200	73,253
19 Sides	19				1,722		12,600			1,308	12,600	3,030
FR	[illegible]	103,620	01-Jun	10-Jun	64,282	May	343,000	15-Nov	26-Mar	278,111	343,000	342,393
23IN	23-1 to 23-6	110,230	01-Jun	03-Aug	194,945	May	338,300	15-Nov	02-Mar	91,601	338,300	286,546
COASTWIDE		3,447,285			4,525,292		5,071,285			667,838	5,956,046	5,286,731

Catch ceilings in effect from April 1, 2000 to March 31, 2001. Landings are from adjusted weights reported from the final AMR Report.

Landings from Shrimp Trawl report. From November 9 for first opening of the areas with 2 openings and from May 17/01 for all others

Southern Inside Waters had two openings. 60% of the landings were allowed to be taken in the first opening. Second opening was November 15.

* 12IN remained open throughout the 2 openings as the quota was not achieved

** Following a review of the landings the annual coonstripe quota was achieved in the first opening.

Table 4.2.6. Recent shrimp trawl landings by Shrimp Management Area.

North Coast SMA	Landings (t) 1998/99	1999/00	2000/01
DXE			
QCI	25.0		
2IN		12.0	#
3IN	9.7	51.9	57.4
PRD	250.5	476.4	312.1
5IN	5.5	17.1	12.4
5OFF			
6IN	8.2	10.2	9.3
6OFF	25.6	#	
7IN	11.3	0.9	2.4
8IN	5.9	#	#
9IN	42.1	47.8	21.4
10IN	#	0.6	#
QCSND	868.8	25.3	
North Coast Totals	**1,252.9**	**642.3**	**424.0**
Coastwide Totals	**3,268.3**	**2,385.9**	**2,461.0**

South Coast SMA	Landings (t) 1998/99	1999/00	2000/01
11IN	11.1	#	#
12IN	174.7	93.8	60.2
12OUT	13.7	12.5	15.1
GSTE	202.4	75.6	89.6
14	90.5	132.6	115.8
16		38.2	32.4
17	11.8	8.2	8.9
18	76.6	51.1	30.4
19	19.2	36.9	64.7
FR	184.8	107.9	158.6
East Vanc. Is. Totals	**785.0**	**556.8**	**576.2**
20		#	
21OFF			46.9
23IN	66.9	63.9	141.2
23OFF	872.4	1,027.9	1054.7
24IN	#	1.4	2.1
124OFF	32.2	7.1	94.3
25IN	3.0	4.4	7.5
125OFF	187.8	42.7	54.0
26IN	1.7	1.4	
126OFF	#	#	
27IN	6.7	#	#
27OFF	49.3	37.7	50.6
WCVI Totals	**1,230.4**	**1,186.8**	**1,460.8**
South Coast Totals	**2,015.4**	**1,743.6**	**2,037.0**

# Landings do not meet confidentiality requirements.

Table 4.2.7. Comparison of Logs and Landing Records for the Shrimp Trawl Fishery by species for 2000/01 fishing season (tonnes).

		Landing Records (lbs.)			**Landed Value**	
	Logs	Adj. Weight	Est. Weight	**Avg. $/lb**	Adj. Weight	Est. Weight
Pinks		4,562,607	5,002,859	$0.51	$2,312,557.36	$2,535,699.08
Sidestripes		530,049	593,849	$2.14	$1,133,509.79	$1,269,946.09
Prawns		1,169	885	$5.85	$6,838.65	$5,177.25
Humpbacks		74,509	78,116	$3.62	$269,916.30	$282,983.02
Coonstripes		118,956	116,491	$2.96	$352,074.07	$344,778.41
	-	5,287,290	5,792,200		$4,074,896.17	$4,438,583.85

NOTES:
Pinks include: generic shrimp, flexed pink, smooth pink and spiny pink
Adjusted weights: final plant weight proportioned to area from skipper's hail and proportioned by species from buyer/plant.
Estimated weights: skippper's estimate of weight on landing record

Table 4.2.8. Summary of stock assessment surveys of shrimp stocks in B.C.

Area	**Year**	**Month**	**Species**	**Biomass** (tonnes)	**Shrimp** (thousands)				Shrimp/ Kg
					0 Year	1 Year	2 Year	3 Year	
PRD	1998	SEPT	N. Pink	501					
			Smooth Pink	347					
			Sidestripe	390					
			Humpback	1					
			Flexed Pink	0					
PRD	1999	SEPT	N. Pink	1,477					
			Smooth Pink	598					
			Sidestripe	657					
			Humpback	8					
PRD	2000	JULY	Humpback	5					
			Sidestripe	465		27,008	24,747	12,080	
			Smooth Pink	226		16,491	29,655	8,210	
			N. Pink	473		82,820	79,766	14,301	
QCSND	1998	JULY	Pinks	2,870					
			Sidestripe	233					
QCSND	1999	JUNE	Pinks	1,038		66,725	188,218	81,824	
			Sidestripe	183		196	5,557	6,204	
QCSND	2000	MAY	Sidestripe	152		7,514	2,270	8,381	
			Smooth Pink	2,683		103,322	508,391	187,277	
7IN	1998	JULY	Pinks	52					
			Sidestripe	11					
9IN	1998	JULY	Pinks	123					
			Sidestripe	111					
9IN	1999	JUNE	Pinks	234		8,124	28,883	27,678	
			Sidestripe	68		1,476	3,653	1,837	
9IN	2000	MAY	Sidestripe	42		1,178	619	2,302	
			Smooth Pink	74		1,085	8,482	7,848	
12OUT	1997	NOV	Spiny Pink	7		8	889	716	230
			Smooth Pink	15					
			Humpback	0					
			Sidestripe	50	301	1,899	2,190	946	107
12OUT	1998	SEPT	N. Pink	15					
			Coonstripe	2					
			Smooth Pink	25					
			Sidestripe	103					
12OUT	1999	JULY	N. Pink	11					
			Smooth Pink	22					
			Sidestripe	46					
12IN	1997	APR	Spiny Pink	527		13,991	50,482	26,700	497
			Humpback	49		998	2,617	2,134	444
			Sidestripe	19		1,837	1,167	645	470
			Coonstripe	2					
		NOV	Spiny Pink	171	770	11,821	10,558	4,978	655
			Humpback	15	17	1,270	536	24	381

Table 4.2.8. con't

			Sidestripe	17	302	1,116	527	420	380
			Coonstripe	0					
			Smooth Pink	0					
12IN	1998	JUNE	Pinks	432					
			Coonstripe	458					
			Sidestripe	33					
			Humpback	32					
12IN	1999	JULY	Pinks & Coons	153					
			Sidestripe	51					
			Humpback	6					
12IN	2000	AUG	Coonstripe	2					
			Flexed Pink	0					
			Humpback	35					
			Sidestripe	133		17,185	997	2,652	
			Smooth Pink	30		6,387	2,737	482	
			N. Pink	315		28,123	30,706	848	
GSTE	1999	AUG	N. Pink	25					
			Coonstripe	0					
			Humpback	11					
			Smooth Pink	232					
			Sidestripe	51					
GSTE	2000	SEPT	Humpback	3					
			Sidestripe	45	1,677		2,411	1,868	
			Smooth Pink	232	954	12,222		23,581	
16	1999	AUG	N. Pink	20					
			Smooth Pink	72					
			Sidestripe	27					
16	2000	SEPT	Sidestripe	25	1,113	2,958	394		
			Smooth Pink	55					
			N. Pink	46	100	11,694	2,397		
18	1999	AUG	N. Pink	98					
			Coonstripe	31					
			Flexed Pink	0					
			Humpback	0					
			Smooth Pink	2					
			Sidestripe	36					
18	2000	SEPT	Coonstripe	22		1,306	2,348		
			Flexed Pink	0					
			Humpback	0					
			Sidestripe	16	107	1,288	257	299	
			Smooth Pink	0					
			N. Pink	164	1,075	47,920	12,553		
19	1999	AUG	N. Pink	135					
			Coonstripe	62					
			Flexed Pink	3					
			Humpback	0					
			Sidestripe	14					
19	2000	SEPT	Coonstripe	111		6,052	4,953	4,035	

Table 4.2.8. con't

			Flexed Pink	0					
			Sidestripe	17					
			N. Pink	590	1,725	190,260	20,331	7,188	
FR	1998	AUG	N. Pink	512					
			Smooth Pink	11					
			Sidestripe	237					
FR	1999	MAY	N. Pink	255		18,313	38,870	3,738	
			Smooth Pink	47		6,584	2,978	658	
			Sidestripe	129		1,010	5,080	6,510	
FR	2000	JUNE	Sidestripe	179			21,545	3,098	4,433
			Smooth Pink	10					
			N. Pink	436		156,892	38,870	12,778	
23	1999	MAY	Pinks & sidestripe	156					
23	2000	MAY	Sidestripe	57		5,894	1,559	1,109	
			Smooth Pink	385		22,833	57,919	10,689	
			N. Pink	28					
123	1996	MAY	Smooth Pink	3,481		465,462	396,894	121,133	283
123	1997	MAY	Smooth Pink	1,136		67,832	200,088	56,242	285
123&121	1998	MAY	Smooth Pink	1,082					
123&121	1999	MAY	Pinks & sidestripe	1,085					
123&121	2000	MAY	Sidestripe	134		19,594	1,337	767	
			Smooth Pink	6,365		1,062,946	938,864	156,488	
			N. Pink	587					
124	1973	MAY	Smooth Pink	13,042		567,904	914,308	1,725,593	246
124	1975	MAY	Smooth Pink	14,155		220,484	1,132,662	2,072,664	242
124	1976	MAY	Smooth Pink	11,523		47,841	1,772,939	1,170,189	260
124	1977	MAY	Smooth Pink	5,742		24,338	755,827	846,257	283
124	1977	SEPT	Smooth Pink	5,413		62,630	751,724	496,517	242
124	1978	MAY	Smooth Pink	1,244		46,076	58,848	171,251	222
124	1978	SEPT	Smooth Pink	654		8,566	11,150	83,535	158
124	1979	MAY	Smooth Pink	1,234		49,096	102,591	113,418	215
124	1980	MAY	Smooth Pink	569		5,011	86,314	36,359	224
124	1981	MAY	Smooth Pink	1,602		39,967	207,687	113,992	226
124	1982	MAY	Smooth Pink	786		6,107	63,186	87,619	200
124	1983	MAY	Smooth Pink	23		219	1,477	2,610	185
124	1985	MAY	Smooth Pink	1,854		138,904	251,691	39,598	232
124	1987	AUG	Smooth Pink	4,389		227,119	503,485	191,882	210
124	1988	MAY	Smooth Pink	4,804		123,899	427,026	466,443	212
124	1989	MAY	Smooth Pink	3,636		48,064	542,137	296,091	244
124	1990	MAY	Smooth Pink	2,804		7,028	304,729	354,012	238
124	1991	MAY	Smooth Pink	2,930		64,361	260,822	354,565	232
124	1992	MAY	Smooth Pink	1,354		57,360	129,137	115,348	223
124	1993	MAY	Smooth Pink	1,018		18,609	153,012	58,016	226
124	1994	MAY	Smooth Pink	1,565		73,543	317,915	29,603	269
124	1995	MAY	Smooth Pink	601		10,528	113,882	26,657	251
124	1996	MAY	Smooth Pink	295		8,421	35,732	23,351	229
124	1997	MAY	Smooth Pink	590		22,549	111,537	27,334	274
124	1998	MAY	(all?)	250					

Table 4.2.8. con't

124	1999	MAY	(all?)	371				
124	2000	MAY	Smooth Pink	1,769	145,153	390,594	21,252	
125	1973	MAY	Smooth Pink	1,840	125,605	201,188	255,990	317
125	1975	MAY	Smooth Pink	2,324	31,897	208,198	313,027	238
125	1976	MAY	Smooth Pink	6,475	69,248	626,144	960,745	256
125	1977	MAY	Smooth Pink	4,001	80,028	863,875	291,430	309
125	1978	MAY	Smooth Pink	966	27,981	95,749	103,083	235
125	1978	SEPT	Smooth Pink	4,223	1,129	439,969	452,950	212
125	1979	MAY	Smooth Pink	1,341	94,597	159,197	125,515	283
125	1980	MAY	Smooth Pink	960	93,615	220,512	31,009	359
125	1981	MAY	Smooth Pink	2,287	115,614	320,724	198,532	278
125	1982	MAY	Smooth Pink	203	1,984	24,025	24,291	248
125	1983	MAY	Smooth Pink	836	14,994	195,329	24,081	280
125	1985	MAY	Smooth Pink	690	92,708	110,102	13,633	314
125	1987	AUG	Smooth Pink	1,575	78,314	190,641	81,916	223
125	1988	MAY	Smooth Pink	586	24,828	77,712	51,462	263
125	1990	MAY	Smooth Pink	965	32,067	179,897	83,846	307
125	1992	MAY	Smooth Pink	5,564	296,828	854,672	381,641	276
125	1993	MAY	Smooth Pink	3,483	62,671	708,586	226,234	286
125	1994	MAY	Smooth Pink	1,126	82,656	226,071	15,058	287
125	1995	MAY	Smooth Pink	985	36,828	214,699	28,795	285
125	1996	MAY	Smooth Pink	846	69,511	153,380	58,033	332
125	1997	MAY	Smooth Pink	417	13,994	66,359	30,832	267
125	1998	MAY	(all?)	54				
125	1999	MAY	(all?)	442				
125	2000	MAY	Smooth Pink	1,998	258,877	463,810	28,586	

Appendix 4.2.1. History of management actions in the shrimp trawl fishery (R. Harbo).

Year	Management Actions - Comments

1376- The first complaints about beam trawls and bycatch, England (W. L. Scofield, 1948). "Some arrangement of beam and bag net, essentially a trawl, was used in England, causing complaint to Parliament in 1376 that certain fishermen had subtly devised a contrivance to which was attached a net of so small a mesh that no manner of fish could escape and such practice was to the great damage and destruction of the fisheries of the Kingdom".

1895- Earliest records of trawling for shrimp in B.C.

1930's-1940's A seasonal closure to shrimp in upper Burrard Inlet, Dec. 1-Mar. 31, the main egg-bearing period for "coonstripe" or "dock shrimp". This fishery collapsed due to overfishing or pollution from oil refineries in the area or a combination of both. The only shrimp closure on the coast apparently has had little effect. (T. Butler, memo Feb. 1975).

?1948- shrimp cannery at Bones Bay, New England Fish (CanFisCo)- a number of small beam trawl vessels fished in Cleo Channel and surrounding areas. Deep Bay- there was a fleet of beam trawl vessels and a shrimp cannery.

1950's, 1960's: FRB developed information on fishing grounds:
- Nootka Grounds discovered in 1955, later fished in 1973
- Quatsino grounds discovered in 1954

1957- Seattle was the first site of a mechanical peeler on the Pacific coast, leading to rapid demand and increases in landings from California to Alaska.

1964- Territorial Sea and Fishing Zones Act- 9 mile fishing zone outside the three mile territorial limit; headland to headland baselines.

1967- All fishing within 3 mile limit; shrimp landings of 1,695,600 lb. (769 t) valued at $332k. Reports by Pacific Marine Fisheries Commission (PMFC) Shrimp fishing areas (Butler 1969)

1972- Fisheries Industrial Development Branch chartered, M.V. Pacific Trident for exploratory shrimp trawling on the west coast of Vancouver Island (WCVI).

1974- Total landings est. 3,056,911 lb. (1387 t) including landings from:
- six Washington shrimpers landed -456,500 lb. (207 t) from W.C.V.I.
- Vessels from Oregon fished April to Oct. and landed in the Astoria, Ore. area- 859,111 lb. (390 t).
- Canadian vessels landed 1,741,300 lb. New shrimp peeler in Tofino with three vessels landing an estimated at 1.5 million. Estimated to be 13 vessels equipped for shrimp trawling.
- Concerned expressed about quality of shrimp north of Oregon due to microsporidian parasite that affects the appearance and odor of landed shrimp.
- MSY est. to be 7 million lb. for W.C.V.I.
- Comments on exploratory fishing 1972-73
- tows in the Goose Island Gully-SSW Hakai Pass- 40 sq. mi.
- tows on Pearl Rocks- 10 to 12 sq. mi.
- est. 162 sq. mi. off Tofino as of May, 1973.

1975- Landings on WCVI included:
  - 265,000 lb. US vessels + 1,100,000 Cdn = 1,365,000 lb. reported
- Due to falling prices for shrimp, the operation of both processing plants on the WCVI were in receivership until the future of the plants was determined (memo, June 12,1975)

1976- Landings reached a high of 11,100,000 lb. (5035 t)
- 3,600,000 by US vessels and 7,500,000 lb. by Cdn. vessels (est. 12)*
- Approx. 12 Canadian and 12 American shrimp trawlers fishing Tofino and to a lesser extent Nootka grounds. Canadian vessels delivering to Tofino and Ucluelet.

- *Canadian fishers report that there were as many as 20 US vessels and the reported landings of 3.6 million are low. Some of the catch delivered to plants in the US may not have been recorded as being landed from Canada.

1977- Surveys and assessments indicate annual limits of 5.7 million lb. for Tofino grounds and 2 million for Nootka grounds (this was less than the 11. 1 million lb. landed in 1976)

Feb. 9/77:

- **licence limitation** announced limiting participation in the shrimp fishery in 1977 to those vessels that recorded landings in 1975 and/or 1976 . This applied to all areas of the coast.
- **W.C.V.I.- closure** 6:00 pm June 30,1977 to midnight August 31,1977, "*fully supported by the Shrimp Producers Association of B.C.*".
- 1.2 million lb. (29%) was expected to be harvested on the WCVI by US vessels (US west coast landings at the time, Ca-Ore approx. 40 million lb.)
- **overcapitalization**: "*it has been brought to the attention of the Department that processors are expanding their capability to handle shrimp to a level far in excess of the harvest that can be permitted from the Tofino grounds*".
- *In 1977, the WA-OR-CA fishery landings approached 200 million lb., with 250 boats and 750 men. However, Alaska landings plummeted from 51 to 31 million lb.*
- In the 1970's there were as many as 90 shrimp-peeler machines in Alaska.

1978- Two surveys by FRB, M.V. G.B. Reed and one by commercial fishing vessel.

- A TAC of 2 mill. lb. was recommended for the Tofino grounds. Shrimp landings in June-July from Tofino were 200,000 lb. compared to over 2 mill. lb. in the same period in the year previous (1977).
- An open fishery was allowed for the Nootka grounds "as a trial for alternate management strategy". Over 1.8 million lb. were taken in June-July 1978.
- The management policy was "to maintain an adequate brood stock of shrimp to produce an optimum yield from the available stock".
- **Canada extended its fishing zone to 200 mi.** under Canada's Extension of fisheries Jurisdiction. The Nootka grounds had not been fished by US vessels because it lied within Canada's 12- mile exclusive fishing zone.

1979- 237 S licences issued and 71 Northern Area permits (only 50% active in the fishery)

- In 1979- there were a number of stock collapses, landings fell to a nine year low of 98 million lb. but the number of vessels increased to 300.

1980- Publication of Butler's "Shrimps of the Pacific coast of Canada."

1981- W.C.V.I. **TAC recommended for Tofino grounds was 200 t.** The quota was taken and the area closed to fishing until another TAC is set in May, 1982 (Bernard 1982).

- **TAC for Nootka grounds was 520 t,** open to fishing until the quota was reached or April 30,1982 (Bernard 1982)

1982- 249 S licences issued.

- **Permit fishery for Trevor Channel, Barkley Sound**, considered underutilized; precautionary quota recommended 113 t, April 1, 1982 to March 31, 1983; logbooks required.
- ***Report by Pearse Commission on Pacific Policy, stated that the first obligation of the federal government is to ensure conservation of the resource.***

1984- Report on '82-83 logbook & catch sampling in Barkley Sound (Boutillier & Harling in Jamieson '85)

1985- W.C.V.I. - 21 vessels reported landings of 192 t on W.C.V.I.

1986- Report on surveys- biomass and area for Tofino and Nootka grounds- 1973 to 1985 (Boutillier in Harbo and Jamieson 1987).

- 247 S licences; five scientific permits were issued for a portion of Barkley Sound. This lead to one licence being granted (1991) with restrictions on the Area of Fishery.

1987- **Mandatory harvest logs** set as a condition of the shrimp licence.

1988- Dioxin closures.

1989- Year round fishery. **New management action to set Target Catch at 2268 t (5 million lb.) for offshore W.C.V.I.**

1980's- Fishers report that there were many improvements in net materials with polyethylene webbing and knotless webs. There were also improvements in aluminum beams for beam trawls.

1990- Assessment of Area 124-Tofino grounds: recommend a closure at the end of Oct. coincident with the end of the US fishery (Boutillier in Thomas 1990)

- Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore W.C.V.I.
- **Prawn bycatch restriction**- 1% or 5 lb. whichever is greater, during open times for prawns.

1991- Assessment of Area 124 Tofino grounds: TAC recommended between 810 & 842 t (Boutillier 1992)

- Recommendation to delay Area 124 opening until mid-May or June to maximize yield per recruit.
- Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore W.C.V.I.
- Prawn bycatch restriction- 2% or 5 lb. whichever is greater, during open times for prawns
- Three shrimp trawl permits (1 north, 2 south Areas 17-18) issued to allow for retention of prawns to allow the fishers to seek alternate shrimp fisheries or appeal for a shrimp (prawn) trap licence.
- A restricted "S" licence was issued for beam trawling in Subareas of Area 23.

1992- Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore W.C.V.I.

- Prawn by-catch restriction- 2% or 5 lb. whichever is greater, during open times for prawns.

1993- Year round fishery. Target catch set at 2268 t (5 million lb.) for offshore W.C.V.I.

- Prawn by-catch restriction- 2% or 5 lb. whichever is greater, during open times for prawns
- By-catch limits set for squid at 2% of the shrimp weight.

1994- Preliminary review of logbook data for inshore shrimp fisheries.

- Prawn by-catch restriction- 2% or 5 lb. whichever is greater, during open times for prawns.
- For vessels with both prawn trap, W and shrimp trawl S licences, prawns must be offloaded before fishing under the authority of the S licence.

1995- Fraser River Sockeye Public Review Board- Chaired by John Fraser-focused on salmon, but reinforced the need for "risk averse management" and called for greater attention to more precautionary management approaches for all west coast fisheries.

- There were significant increases in active licences (165 in 1994 to 216 in 1995); fishing days (7,311 in 1994 to 14,324 in 1995); total landings (3192 t in 1994 to 6777 t in 1995) and total value ($4.7 m in 1994 to $13.7 m in 1995)
- Prawn by-catch restriction- 2% or 5 lb. whichever is greater, during open times for prawns. McIntyre Bay closed May 1 to Sept. 30, to reduce bycatch of halibut.
- First elected Shrimp Trawl Sectoral Committee established in September.
- Dioxin closures lifted for shrimp by trawl in all areas Feb. 10.
- International Code of Conduct for Responsible Fisheries adopted by FAO, United Nations, development of "Canadian Code of Conduct for Responsible Fishing Operations.
- Non-retention of prawns in Area 17.

1996- Closures on the WCVI: Subareas 23-6 to 23-11, 21,121,123,124 were closed for the first time, effective Jan 1.1996 to 08:00 April 1,1996.

- Prawn by-catch restriction - 2% or 5 lb. whichever is greater, during open times for prawns.
- Subareas 28-11 to 28-14 closed until evaluated.
- Area 1 and 101 closed year round due to concerns about halibut by-catch.

1997 (1997/98 season)

- **January 1 to April 1- Interim fishing plan**
- **Fishery Closures on the WCVI**: Subareas 23-6 to 23-11, 21,121,123,124 were closed, effective Jan 1.1997 to 08:00 April 1,1997.
- **April to June 1- interim fishing plan**
- Registration of the Pacific Coast Shrimpers' Cooperative Association (PCSCA).
- Company designated to provide monitoring of landings and bycatch observers.
- Area 12 surveys- inside Subareas- April/97. Fishery opened April 21,1997.
- TAC set August 8, reached by Oct. 2 closure.
- 12OFF was assigned 10 t precautionary quota, closed Aug.19. Surveyed in November, reopened Dec. 19 for additional 20,000 lb.

June 18, 1997 / April 15 1998

- New fishing plan with hail requirements, catch monitoring and bycatch monitoring programs.
- DFO Shrimp Fishery Manager funded jointly by DFO and industry.
- New Shrimp Trawl Landing Records (PCSCA/ AMR)
- Revised Shrimp Trawl Fishing Logbook (J. O. Thomas)

- Catch ceilings in effect to March 31, 1998; fishing plan in effect to April 15, 1998 with new catch ceilings to be announced for the period April 1, 1998- March 31, 1999.
- November 1997. New shrimp trawl sectoral committee selected by industry vote.
- Dec.4, 5, 1997. Meetings of bycatch subcommittee and Queen Charlotte Sound fishers.

1998 (1998/99 season)

- Catch ceilings are in effect for most Shrimp Management Areas (SMAs) for the period **April 1, 1998 to March 31, 1999**. Management Plan is in effect from April 16/98 to April 16/99. Catch monitoring program, Catch sampling and Stock Assessment Programs, continued.
- **WCVI** (west coast of Vancouver Island) - 6-month seasonal opening from May 1 to Oct. 31, 1998.
  - Catch ceilings for two remote, large offshore areas (**SMA QCI** and **6OFF**) are increased in-season from 22,050 lbs. to 55,155 lbs., to ease exploratory access.
  - **Surveys** in twelve Shrimp Management Areas, as well as on the west coast of Vancouver Island. Fixed exploitation rates of 25 - 33% of the total estimated biomass is applied.
  - The survey in May indicates **low stocks on the west coast** of Vancouver Island. Barkley Sound is closed immediately following the survey results that show the quota has already been attained.
  - Additional quota is allotted and **eight SMA's reopen, based on survey results**. Three areas surveyed in the fall of 1998 in Georgia Strait indicate that the quota has been attained during the fishery and there should be no further re-openings.
  - **Bycatch action levels for eulachon** implemented to reduce eulachon bycatch by 50% from the preliminary estimates of eulachon bycatch for 1997 (Hay *et al.* 1998; final estimates Hay *et al.* 1999). WCVI 35 t. QC Sound 50 t.

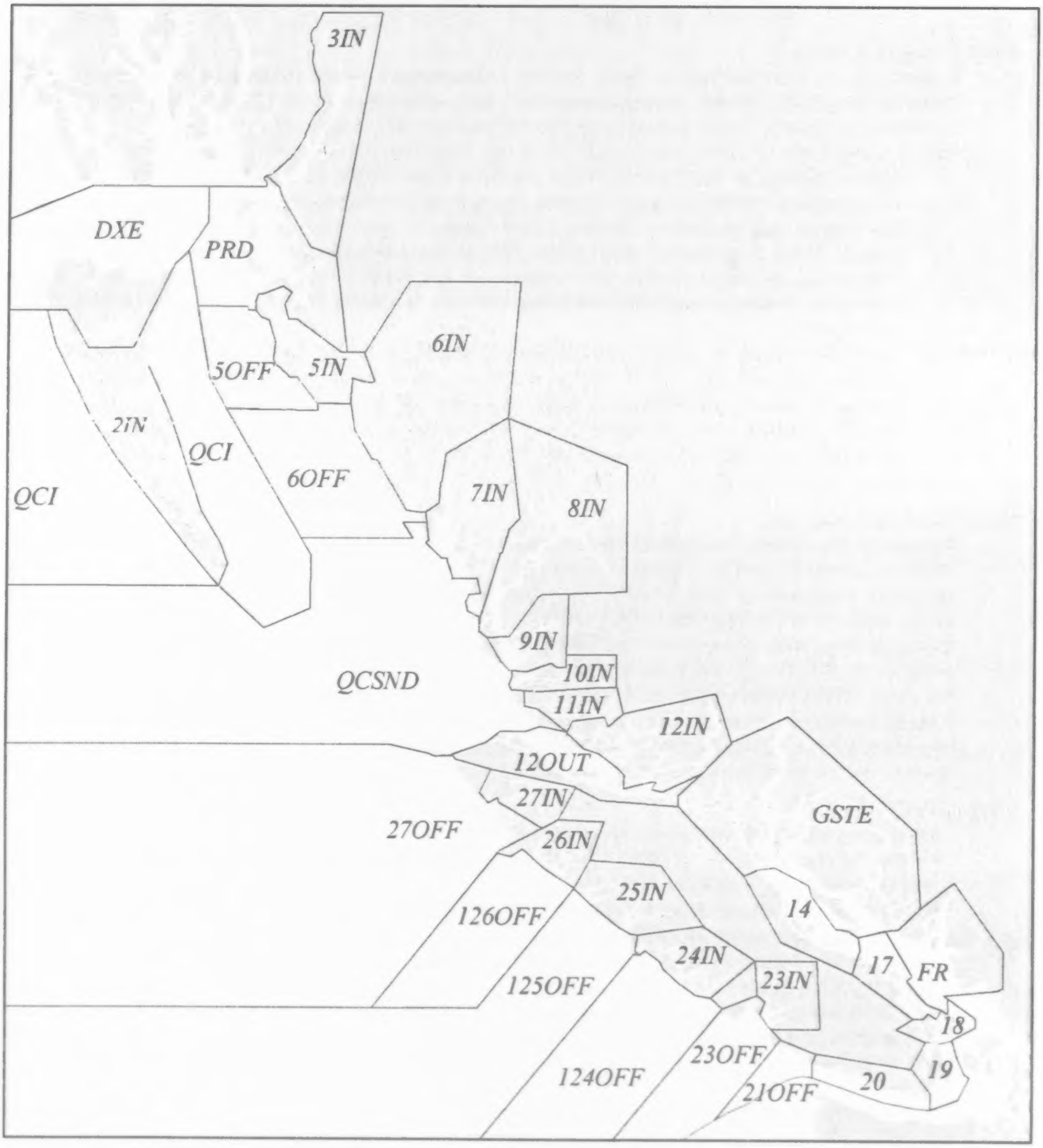
1999 (1999/2000 season)

- Election of the Shrimp Trawl Sectoral Committee for 3 year term
- WCVI – 4-month season. Initial 3-month season set in expectation of low shrimp abundances; extended in-season in SMA 23OFF on review of survey and catch information. Eulachon bycatch action level for WCVI reduced to 24 t with reduced season.
- Biological forecasts (growth and mortality estimates applied to the biomass in the previous season) used for the first time to set initial catch ceilings.
- Southern Inside Waters given split openings (4) on recommendation from STSC
- Annual surveys in "index areas" continued. Biomass estimations made for the first time (2 areas) by indexing from surveyed area to adjacent non-surveyed area.
- Bycatch action level for eulachon on the WCVI was 24t.

2000 (2000/01 season)

- Mandatory selectivity devices in all shrimp trawls.
- Fishery opening delayed to June 1, 2000 to allow the spawning cycle to complete and facilitate a coast wide opening, maximize markets.
- WCVI 5 month season June 1 to October 31, 2000 (revised in-season). Initial action level WCVI maintained at 24 t (same as 1999/00).
- Significant increases in abundance of juvenile (1+ year class) eulachon off WCVI.
- Early WCVI closure (July 26/00) on reaching initial precautionary eulachon action level, 26t in 23off. In-season assessment and further biological reference point set to limit mortality on 2+ year old eulachon. WCVI fishery continued under amended conditions of licence to permit use of beam trawl only September 2 to December 31, 2000. Markets, processing plants, local communities affected.
- Fishery closure for eulachon conservation concerns in Queen Charlotte Sound. Survey indicates a significant loss in shrimp fishing opportunity.
- PCSCA holds Bycatch Workshop and begins twin trawl selectivity experiments. Panel of 'plastic lattice' installed in otter trawls indicates substantial reductions in eulachon and other bycatch. Subareas 2-3 and 2-4 closed under New and Developing Fishing Guidelines (humpback shrimp).

Appendix 4.2.2. Shrimp Management Areas of the British Columbia Coast.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12OUT
27IN
GSTE
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26IN
25IN
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126OFF
24IN
17
FR
125OFF
23IN
18
23OFF
19
124OFF
20
21OFF

4.3. Prawn Trap Fishery – J. Morrison, M. Kattilakoski and J. Toole

4.3.1. Overview

This fishery update report's on the commercial, recreational and First Nations fisheries for prawns and other shrimp species harvested by trap. It provides historical background and recent information. It is intended to provide data complete up to and including the year 2000, and additional information from 2001 that was available as of the date of its preparation.

4.3.1.1. Biology, Environment, Habitat

Seven species of shrimp are harvested in BC in commercial, recreational and First Nations fisheries: *Pandalus platyceros* (prawns), *P. jordani* (smooth pink shrimp), *P. borealis eous* (northern or spiny pink), *P. goniurus* (flexed shrimp), *P. hypsinotus* (humpback shrimp), *P. danae* (coonstripe or dock shrimp) and *Pandalopsis dispar* (sidestripe shrimp), All are members of the family Pandalidae. Prawn is the common name for the largest of the Pacific coast shrimp species, *P. platyceros*. They are also known as spot prawns, for their distinctive markings.

Prawns are bottom dwellers. Prawns are found on rocky or "hard" bottoms including reefs, "edges" along drop offs, and coral beds. They are found in a depth range from the intertidal zone to 487 m, from Unalaska Island AK to San Diego CA, at Vladivostok, in the Sea of Japan, and in Korea Strait. Most commercial fishing in B.C. waters occurs in depths of 40 to 100 m.

Humpback shrimp are also known as king shrimp. They are predominantly found on rocky or hard bottoms often in association with prawns, but may also occur on a wide range of other bottom types at depths of 5 to 460 m from Norton Sound, AK to Puget Sound, Washington, and in Korea and Japan.

Coonstripe shrimp also known as dock shrimp occur everywhere from rock to silty sand, where there is shelter, and are most common on mixed substrate bottoms ranging from the low intertidal to 185 m depth, from the Alaskan Peninsula to Baja, California. These shrimp are often found at night concentrated around the pilings of docks, hence the common name. (Jensen 1995).

Other shrimp species are harvested in the trawl fishery but not in the trap fishery, as they do not appear to be attracted to baited traps. These include the smooth pink shrimp, spiny pink shrimp and the flexed shrimp.

All pandalid shrimp species undergo a change of sex in midlife. They mature first as males and mate. Their sexual characteristics change during a transition phase and they become females in the final year or two of their lives. This is called protandric hermaphrodism. The time spent in each stage varies by species and location. In prawns, the change occurs between the 2nd and 3rd years of life.

Spawning typically occurs in late autumn or early winter. Some coastal areas have earlier spawning periods. The females carry the developing eggs under their tails on appendages known as swimmerets or pleopods until the eggs hatch in spring when the larvae are released into the water column. The larvae are in the water column for up to 12 weeks prior to settling out on the bottom where they move to suitable habitats for growth and maturation. The larvae are mixed and spread by ocean currents establishing a metapopulation (mixed) at that life stage. Larval stages exhibit diurnal migrations, moving to depths during daytime and towards the surface at night. Larval mortality is substantial and variable. For example, exposure to reduced salinity surface water may be a significant source of larval mortality in some coastal areas. Accordingly, future stock abundance cannot be forecast on the basis of prior adult stock abundance. Also, with the dispersion of larvae by currents over a relatively long period of up to 3 months, the present adult abundance in a given location is not linked nor a direct result of prior adult abundance at that site.

Prawns may move up and down a bottom slope to different depths and there may be limited horizontal migrations. There is no evidence of extensive lateral migrations to adjacent coastal areas. Parasite patterns suggest that adult stocks are small and discreet. Consequently there may be hundreds of independent adult stocks.

Prawns and shrimp must shed their exoskeleton to grow. As a result, no permanent body structures are retained, and prawns cannot be aged using conventional techniques based on hard body parts. Instead, an analysis of length data that incorporates the animal's sex and maturity condition is used. Males continue to grow and moult throughout the year, while females cease moulting when they begin carrying eggs. Most moulting occurs during periods of increased food supply in the spring and early summer. Each moult can result in a 10% increase in overall length and a 20 to 30% increase in weight.

Prawns live to four years of age. Following release of the larvae, spent female mortality is rapid, usually within several weeks. Few if any prawns survive past the fourth year. This is a short lived species with highly variable recruitment. Consequently, adult abundance cannot be forecast based on recent or historical stock abundance patterns. Most prawns are harvested at age 2+ and 3+. There is no means to forecast harvest abundance from earlier life stages.

4.3.1.2. Species Interactions

Prawn larvae are prey items for other pelagic and planktonic marine organisms. Once prawns have settled to the bottom and have found suitable protective habitat, mortality is reduced. At this stage they will be prey items for bottom fish and octopus. As prawns do not rise off the bottom as occurs with some other shrimp species, they are not exposed to predation by mid water fish species, and are not known to be a prey item for salmon except possibly during the larval stage.

Prawns are opportunistic foragers, consuming fresh, moribund or dead organic material. Stomach contents of prawns near Vancouver held remains of polychaete worms and unidentified crustaceans (Butler 1980).

4.3.2. Commercial Prawn trap fishery

The British Columbia commercial prawn trap fishery began prior to 1914, but did not reach prominence until mid 1970's. The commercial fishery is a limited entry, competitive fishery with seasonal closures, in-season area closures, gear limits, trap mesh size requirements, minimum size limits, daily fishing time restrictions and a single haul limit.

4.3.2.1. Commercial Fleet, Fishers and Crew

The fishery grew from 50 licences in 1979 to 900 licences in 1989 of which 305 reported landings. Limited entry licensing was implemented in 1990. This included vessel length restrictions that prevent the transfer of a licence to a longer vessel. Licence eligibility criteria resulted in the initial allocation of approximately 125 licences. Subsequent appeals increased this to 260 licences. Of these, 15 were "grandfathered".

Grandfathered licences are non-transferable and the eligibility expires when the licence holder leaves the fishery. By 2000 there were 252 commercial licences remaining in the fishery. Of these, 4 are communal commercial licences available to First Nations for participation in the commercial fishery. Of these 4, 3 have been assigned, two to the Nuu-chah-nulth Tribal Council and one to the Sliammon First Nation. Communal commercial licences are monitored with the commercial fishery and have the same hail, landing and management fee requirements as commercial licences.

Vessel sizes in the commercial fishery range from 3.9 m to 19.6 m. The median is 11.3 m. The number of crew varies with the size of the vessel. A single person may operate smaller vessels. Larger vessels may operate with a captain and 3 or 4 crewmembers.

There is no estimate of stock abundance in advance of the commercial fishery, and therefore no total allowable catch limit or individual licence quotas. Instead, an in-season measurement of abundance is used for management. The spawner index is a biological reference point introduced in 1979. The spawner index is the measure of the number of female prawns and transitional prawns that are changing from the male to female state and which will be reproductively mature by the fall and winter of that year, caught in a standard trap fished for 24 hours. The index was initially established based on historical data for Knight Inlet stocks that proved to be sustainable in the face of strong annual fishing effort. Additional information about the spawner index is provided in Section 4.3.7.1, Assessment.

Harvest log requirements were established in 1983. Commercial fishers are required by conditions of licence to provide fish slips reporting landings and value, and logbooks reporting location, effort and catch. Logbook information must be completed by midnight of each day of fishing, and the data provided to the Department within 4 weeks following each calendar month in which fishing occurs, in hard copy and in a specified electronic format. Fishers may develop their own logbooks in accordance with Department specifications, or may purchase logbooks and keypunching services from a private sector company. In practice, some logbook data is not turned into the Department until licence renewal the following year. Increased enforcement of logbook reporting requirements has been recommended.

A minimum size limit of 30-mm carapace length came into effect in 1985. The size limit increased the age of first capture from approximately 18 to 24 months. This increased the weight of an individual prawn when caught and permitted increased growth in the stock before first harvest. Trap escapement modifications specifying minimum mesh size in the trap or tunnels were first established in 1988 to reduce the capture of undersize prawns and to reduce sorting and mortality of the catch. Standardized marking of gear was required in 1990. Hail requirements were introduced in 1992. Daylight fishing only began in 1993. Maximum trap volume was first set in 1994. More than 80,000 traps were reported to be in use by the fleet in 1994. Actual numbers were likely 10% to 20% higher. Numbers of traps were limited in 1995 to 300 traps per licence, setting a maximum inventory of 78,000 traps for the 260 licences in the fishery at that time. Two trap allotments could be combined on a single vessel ("stacking"). When combined, a maximum of 450 traps could be fished on the acquiring vessel. Management fees paid by licence holders began in 1995. Industry requested DFO to increase the minimum size to 32 mm in 1996 to better meet market demands. A further increase to 33 mm was requested and put in place in 1997. A minimum telson length of 22 mm was introduced in 1998, to permit prawn fishermen to legally continue their practice of tailing product at sea. From 1995 to 1998, the actual number of traps fished coast wide was approximately 73,000 traps, 5,000 less than the planned maximum, due to licence stacking, the voluntary use of fewer traps on some vessels, and licence retirement. In 2000, a pilot program tested limiting gear recovery to a single haul per day, in southern coastal waters. This was intended to allow a greater number of large prawns to enter the trap before hauling. Large prawns chase the smaller prawns out of the trap, sorting them out on the bottom to reduce handling mortality from being hauled and released at the surface. Trap limit stacking was permitted to increase to 500 traps for the year 2000 test. Area licensing into 2 coastal areas was used to separate the single haul management area from the coastal areas and vessels which continued to practice multiple hauling. By industry request, the single haul management measure was extended coast wide for the 2001 fishing season, and the area licensing feature was discontinued. Time of day limits from 7:00 a.m. to 7:00 p.m. which were introduced with the pilot program in 2000 were also extended coast wide in 2001.

The commercial prawn fishery has been managed by seasonal closures since 1979. An annual seasonal closure has been in effect in the South Coast (Areas 11 to 29) since 1984 and in the North Coast (Areas 1 to 10) since 1989. Prior to 1994, the closures were generally for the period of January to March, which coincides with the period of the greatest number of egg bearing prawns. The commencement of the annual closure is now based on in-season assessment of the spawner index. Closures are implemented when the mean sampled index is equal to or less than the target spawner index for that month, or when the index is considered likely to achieve the target before re-sampling can occur. Once enacted, the commercial fishing closures are in place until the general opening date of the commercial season in the following year. The closure protects the remaining egg bearing females from commercial fishing mortality through to the end of the larval hatching period.

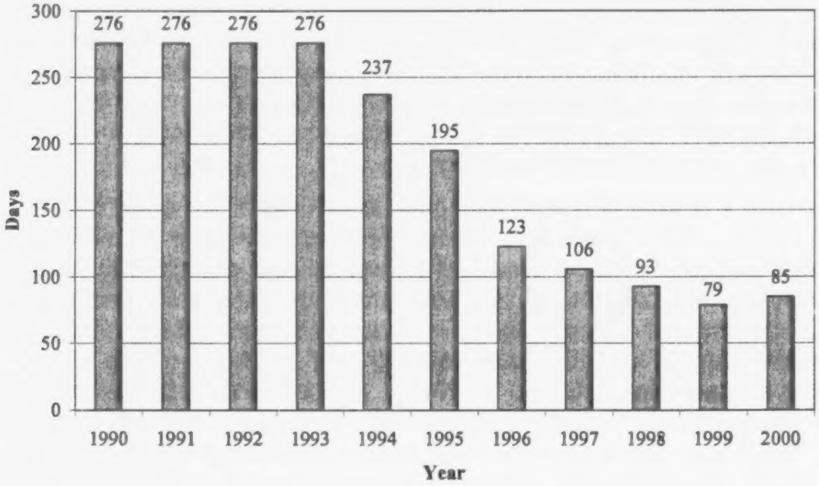

Figure 4.3.1. Prawn fishery season length, 1990 to 2000.

The opening date was adjusted from April 1 to later in the month in the '90's, to allow most egg bearing females to release larvae prior to commencement of the commercial fishing season. Commencing in 2000, the earliest opening date for the commercial fishery is May 1, annually.

Managers implement a coast wide closure of the commercial fishery when the in-season closures of fishing grounds has progressed to the point where approximately 50% or more of the fishing grounds have closed, when the fleet has been concentrated and gear is crowded on the grounds, and spawner index information shows patterns of fishing depletion. The typical pattern for a fished down stock is one in which about 50% of the index values in an area are above the target level, while 50% are below. The coast wide closure has occurred earlier each year since 1994, due to increased fishing effort and improved in-season sampling of the spawner index. In 1999, the fishery opened April 22 and the final closures occurred on July 9 following 79 days of fishing, the shortest season on record. In 2000, the fishery opened May 5 and closed on July 28, for 85 days of commercial fishing. In 2001, the fishery opened May 1 and closed on July 18, for 79 days of fishing.

4.3.2.2. Location of the Fishery

The Pacific coast commercial prawn trap fishery takes place all along the British Columbia coastline in inshore areas. For the period 1997 to 1999, approximately 65% of the vessels fished the waters inside Vancouver Island, consisting of Pacific Fishery Management Areas 11 to 19, 28 and 29 which includes Queen Charlotte Strait, Johnstone Strait, Georgia Strait and the adjacent mainland inlets.

The majority of commercial fishery landings have historically come from the fishing grounds inside of Vancouver Island (66%, 1990 - 1999), with the remainder from the west coast of Vancouver Island (8%) and further north (26%). In recent years there has been increased effort in the Queen Charlotte Islands.

The presence of prawns in areas offshore of the surf line in Pacific Fishery Management Areas (PFMA) 101 to 111, and 121 to 143 is known from shrimp trawl and groundfish trawl fisheries. The short commercial fishing season provides insufficient time and incentive for the prawn fleet to search for additional fishing opportunity in these areas. Instead, there have been a number of proposals for scientific licence based surveys of offshore areas, which resulted in 3 vessels testing portions of PFMA 123 in September 2001. That survey did not find any concentrations of prawns of particular note.

Permanent area closures are listed in Appendix IV of the integrated fisheries management plan. There are few, they restrict commercial fishing activity only and have no impact on First Nations' food, social and ceremonial fisheries, or on recreational fisheries.

4.3.2.3. Procedure for In Season Decision Making

During the commercial fishery, there is a weekly in-season conference call at which time fishery managers and stock assessment personnel review the available spawner index sample results. Comments that have been received from the charter patrol Guardians, fishers and buyers are shared in the group discussion. Information about catch by size grade and the proportion of medium sized prawns in the catch may also be reviewed. Generally, as stocks are fished down the proportion of medium prawns increases. Fleet movements in the past week are reviewed. Vessels leaving an area may be indicative of an area that has been fished down. Vessels entering an area may increase the rate at which the remaining stocks are exploited and the need for increased sampling. The ability to resample areas that are showing signs of fishing pressure is considered. Decisions are made about closure areas, and those areas which require sampling within the next several weeks.

In most cases, the time from sampling to closure is approximately 2 weeks. On occasion, closures may be put into effect within 1 week of sampling, or more rarely, within 48 hours. As individual coastal areas close during the season, fleet mobility increases and vessel effort is concentrated into the remaining open areas. A coast wide closure decision is made when most of the remaining open coastal areas are showing signs of being fished down as characterized by highly variable spawner index results, and when the manageability of the remaining fishing effort is in question due to the concentration of gear. This completes the annual commercial fishing season.

Closure notification is accomplished in a variety of ways. There are official public notices which are fanned out by e-mail and fax from the regional headquarters operations centre. Closures are announced on a schedule once a week on the Canadian Coast Guard mariner's broadcast. The 11 charter patrol vessels receive the information and broadcast it on VHF radio in local waters. The closures are also described on telephone answering machines announcements in Nanaimo and Prince Rupert.

4.3.2.4. Processor Plants and Seafood Buyers

There were 47 companies and individuals involved buying and selling prawn product in the commercial prawn fishery in 1999 and 44 listed for 2000. This includes persons registered for the purpose of dock sales. In 1999, fourteen companies listed more than 100 fish slip transactions, 16 companies reported handling more than 20 t of product for a combined total of 88% of the coast wide landings. Buyer and processor facilities are located in Lund, Vancouver, Richmond, Campbell River and Port Hardy. As with the licence holders, the buyers and processors are distributed to a number of coastal communities where they may make an important contribution to the local coastal economy. Processors must be federally registered by the Canadian Food Inspection Agency to export products from British Columbia.

4.3.2.5. Landings/Value/Markets

Commercial prawn landings and landed value achieved record high levels in 1996, and peaked at 1785 t in 1997. Landings remained in excess of 1700 t in 1998, then declined in 1999. Landings for 2000 were again over the 1700 t level, a return to the levels seen in the peak years from 1996 to 1998.

Commercial landings are now believed to track stock abundance, as all inshore stocks are considered to be fully exploited. Changes in abundance may be due to a variety of biotic and environmental variables. Rockfish and lingcod stocks were depressed by the mid 1990s. These are important predators on prawns. Other predators such as hake were becoming more abundant by the late 1990s. Anomalous water temperatures and reduced plankton presence alleged by fishers in the spring of 1999 may have signalled significant environmental changes. A review of long term salinity variations in the Gulf of Georgia recorded at light stations indicates a period of low surface water salinity in 1996 coinciding with the larval period for the cohort that would become harvestable by 1999. Low salinity can adversely affect larval survival.

In summary, it is impossible to determine a causal factor for the trend toward higher landings in 1996, 1997 and 1998 or for the declines in the Gulf of Georgia and on the west coast of Vancouver Island noted in 1999. By comparison, stock strength in Georgia Strait and Johnstone Strait was improved in 2000, appeared to be comparable to previous years on the west coast of Vancouver Island, and appeared to be similar to or slightly weaker than previous years in more northern waters. This is a short-lived species with highly variable recruitment patterns that cannot be forecast at present from stock conditions in previous years.

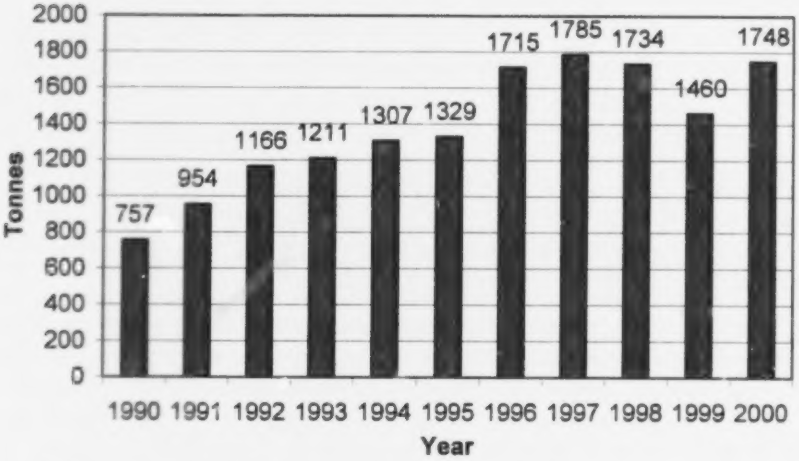

Figure 4.3.2. Prawn landings (tonnes), 1990 to 2000.

Landed value

With a landed value of 17.9 M in 1999, the Pacific coast prawn by trap commercial fishery was the region's 8th most valuable commercial fishery and the 3rd most valuable invertebrate fishery, after geoducks and crabs. Comparative data is not yet available for 2000.

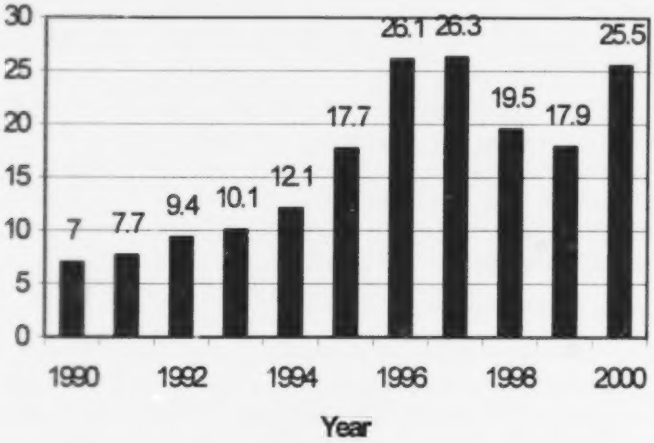

Figure 4.3.3. Landed value of the prawn fishery (millions of dollars), 1990 to 2000.

Landed value peaked in 1997 at more than $26 M. The true landed value for that year is estimated to be in excess of $30 M. A review of the fish slips indicated that some fishers were reporting unrealistically low dockside prices. As well, it was confirmed that there were post season adjustments in which buyers made additional payments for the season's catch. Landed value declined to $19.5 M in 1998 and 17.9 M in 1999 due to changes in the Japanese economy, which is the primary market for more than 90% of the catch. Landed value for 2000 was in excess of $25 M.

Markets and product types

There are several product types; frozen at sea (FAS), fresh landed then frozen, fresh, and live. The FAS product and catch that is landed and then frozen, is "finger packed". This refers to the individual laying of prawns in a 1 kg clean white box, all prawns laid in the same direction and with all antennae tucked into the box. The box must remain unmarred. The prawns are dipped in a sulphite solution to improve colour and storage characteristics. This product is destined for the Japanese market and this market accounts for more than 90% of the catch. Prices vary from year to year, and according to product size. In 2000, the overall landed value was $18.96/ kg while the price ranged according to grade from $17.64/ kg to $27.56.

Live and fresh prawns are sold to local markets, local restaurants or through dock sales. Fresh prawns and some frozen prawns may be sold as whole or tailed product. Tailed product has the head and thorax removed. Dock sale prices in 1999 were typically $12 to $17 /kg. for whole prawns. As tailed product results in 50% weight loss, this product form has a value approximately twice that of whole prawns.

4.3.2.6. Recent Initiatives and Changes

Spawner Index Closure Management

Commencing in 1997, Saanich Inlet has been managed to a 25% higher spawner index in-season, to ensure that there are sufficient prawns for recreational fishing purposes following the commercial season. By 1999, this management measure was applied to all special management areas and several other important recreational fishing areas. In 1999, 2000, and 2001, the Saanich Inlet stock was one of the most abundant on the coast at the commencement of the fishing season, as measured by the in-season spawner index sampling.

In a January 2000 PSARC report, J. Boutillier indicated that harvestable stock surplus could likely be increased by managing the fishery to a higher spawner index. In consideration of this advice, of the opinions expressed by fishers that the intensity of the fishery could "outfish" the spawner index, and of the continuance of the high intensity multiple hauling fishery in northern waters, the fishery was managed coast wide to a 10% higher spawner index in 2000 and 2001.

The 2000 Single Haul Pilot Program

In response to concerns for multiple hauling, the 2000 fishery was a one year pilot program which limited gear hauling to once each day in southern coastal waters. The single haul management feature was intended to allow more time for larger prawns to enter the trap, chasing smaller prawns out and reducing the mortality of undersize prawns from hauling, handling and sorting at the surface. Area licensing was established for the year 2000 pilot management program for one year only, with two areas established to limit fleet mobility between single haul and multiple haul fishing zones. In single haul areas, daily fishing hours were reduced to 12 hours, 7:00 a.m. to 7:00 p.m. for enforcement purposes, to reduce the time available for single haul and to ensure that all hauling took place at times when it would be visible to enforcement personnel on patrol on the water or from charter aircraft patrols. Industry based funding was re-profiled to make $25,000 available for in-season enforcement of the single haul feature, for vehicle and vessel fuel, operating expenses, travel and overtime, surveillance and court expenses by Fishery Officers.

In the post-season review Sept. 26, all industry representatives offered positive comments about the single haul feature of the pilot program. However, dissatisfaction was expressed by some representatives for area licensing and limited daily hauling hours.

Management Funding Changes for 2001

Treasury Board agreement arrangements and supporting fee regulation amendments which provided for management funding by licence holders established in 1995 accompanying the introduction of trap limits, were terminated prior to the 2001 commercial fishing season. This had accounted for $368,000 of program delivery expenses. Responsibilities for information delivery were established by conditions of licence, and were provided by a private sector service provider for approximately $329,000 in the 2001 commercial prawn fishing season. Those services including provision and registration of trap tags, in-season vessel activity hail service, on-board gear and document inspections and spawner index sampling. In addition, more than 90% of licence holders voluntarily contributed $85,000 to the Department for in-season fishery management and stock assessment support, and for enforcement of the single haul management measure. These funds were transferred to the Department by means of a joint project agreement, signed between the Department and a broadly representative industry association, the Pacific Prawn Fishermen's Association (PPFA).

2001 Single Haul Coast Wide

Industry representatives unanimously requested extension of the single haul management condition throughout the coast for 2001, and elimination of the area licensing feature of the 2000 pilot program. A coast wide enforcement funding level of $50,000 was agreed to, limited daily hauling hours were adopted coast wide, a licence condition was added to prohibit revisiting gear on a single day, and conditions were established for string by string recording of logbook data within 0.5 hrs. of resetting the gear.

Commercial Harvest Plan Development by Industry

The elected industry representatives of the Prawn Sectoral Committee were offered the opportunity beginning in 2001 to develop future commercial harvest plans. They have been advised that plans must meet requirements for:

- conservation, (in-season spawner index monitoring)
- constitutional obligations to First Nations for food, social and ceremonial food fisheries,
- enforceability
- cost neutrality to the Department
- supported by a majority (67%) of licence holders, and
- providing sufficient time for the Department to undertake consultation with other stakeholders and to achieve internal review and sign off.

The Department will assist industry in facilitating industry meetings for commercial plan development, but will continue to be responsible for the preparation of the Integrated Fishery Management Plan, including the commercial harvest plan documents, recreational and First Nations harvest components.

4.3.2.7. Current Issues

Coliform Bacteria & Prawns

Coliform bacteria are present in prawns coming over the rail on commercial vessels. Refer to the minutes of the Sept. 21, 2001 Prawn Sectoral Committee for a complete review of this issue. A subcommittee has been struck including representation from licence holders, buyers, the Department and CFIA. An advisory document will be prepared and distributed prior to the 2002 fishing season, to assist buyers and fishers) in recommended practices to maintain product quality

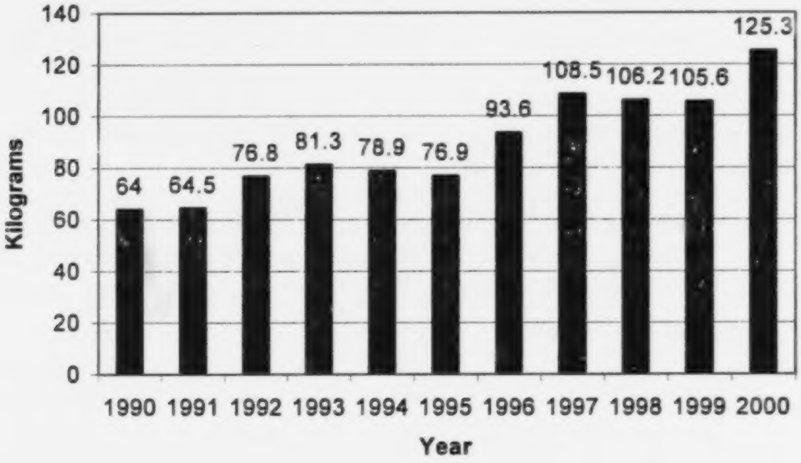

Figure 4.3.4. Landings (kg) per unit effort (vessel hours), 1990 to 2000.

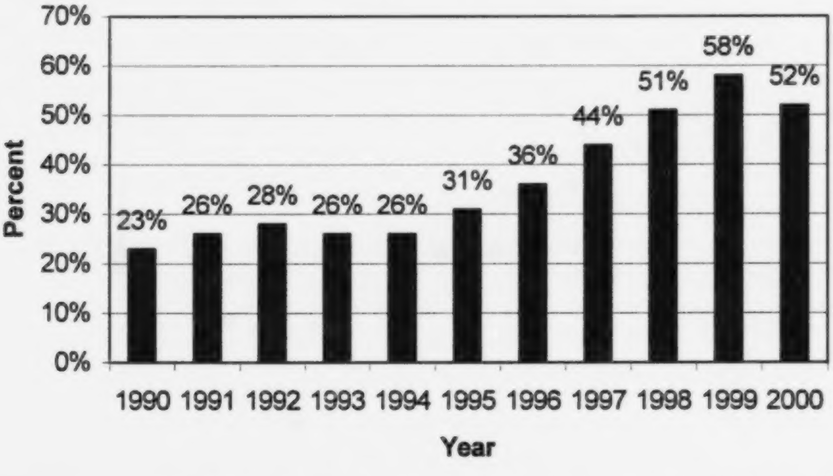

Figure 4.3.5. Percent of landings in first 30 days of the fishery, 1990 to 2000.

Intensity of the Commercial Fishery & Multiple Hauling

Before 1995, most fishers would haul their traps once per day and had enough traps to keep fully occupied for each day of fishing. Trap limits were introduced in 1995. By 1996, some fishers were hauling their traps twice per day, particularly early in the season when stocks are strongest. By 1997 it was estimated from an industry survey that more than 60% of the fishers were "double hauling" their gear at the beginning of the fishing season. Fishers began expressing their concern for this practice and the sustainability of the fishery in 1998 and 1999. By 1999, some fishers were engaged in "triple hauling" portions of their gear at the beginning of the fishing season.

Fishers' representatives stated their belief that the intensification of effort could "out fish" the spawner index as a management measure to achieve conservation goals.

A single gear haul per day limit was introduced in southern inside waters in 2000, and at industry's request extended to all coastal areas in 2001. However, this is a difficult licence condition to enforce. There are reports of non-compliance with this management measure, and concern that compliance will further erode.

New Trap Types

Variations in trap types have been introduced since 1995. Some have a higher efficiency and are now seeing broader use throughout the fishery. The efficiency of a new variation large volume trap first seen in 2000 has not been assessed. Parlour type traps were seen in 2001. Introductions of new trap types makes spawner index assessments more difficult, and creates an obligation on the Department for additional testing, an obligation that is difficult to meet with current resource levels. It would be useful to adopt a schedule of accepted trap types, and require persons who propose to introduce new trap types to undertake or fund trap efficiency testing to standards satisfactory to the Stock Assessment Division, prior to their introduction to the fishery.

Single vs Multiple Service Providers

There was no industry service provider in 2000. From 1995 when trap limits were introduced until 2000, all management fee funds were received by the Department, and then used to contract observers for the in-season fishery, as well as for the purchase and distribution of trap tags. This was all "in-house". The expiry of the Treasury Board agreement at the end of the 2000 fiscal year forced the change that introduced an industry service provider in the fishery commencing in 2001.

Collaborative Agreement & Industry Association

There was no collaborative agreement with industry, and no single representative industry organization in 2000. From 1995 to 2000, in-season management funding was achieved by a regulation that required fishers to pay additional management fees upon application for W licence issuance prior to the season opening, and a Treasury Board agreement which returned the management fund portion of the fee to the Department.

4.3.2.8. Future Issues

Markets

An estimated 90 to 95% of the landed product continues to be marketed to Japan. Buyer's information at the Sept. 21, 2001 meeting of the Prawn Sectoral Committee meeting suggests that there is risk of a significant reduction in prices offered to fishers for the next fishing season. Prices paid to fishers in 2001 declined in response to an increased supply of prawns from Russian fisheries. Additional supplies of a comparable sized shrimp are expected to enter the market from Argentina, in 2002. Although the impact may be significant, it is unlikely that the management plan can be amended to reduce this risk. Potential effects include impacts on fishers debt loads, lease arrangements, vessel/licence prices, and willingness to voluntarily contribute to collaborative agreement funding programs in support of Department delivery of the fishery.

Future Management Options

There are two major views held by licence holders and their representatives considering the future direction of the commercial fishery. Some advocate continuance of the competitive fishery with further input controls or a variety of new management measures (trap reductions, trap quota transfers, rotational fisheries) while others heartily recommend adoption of an individual quota like system. A Future Management Options subcommittee of the Prawn Sectoral Committee developed a report in 1999 which described many of the alternatives available within the fishery. A general licence holder meeting in September 2000 furthered discussions which are available as minutes for that meeting.

4.3.3. Commercial Humpback Trap Fishery

The commercial humpback trap fishery is a directed fishery undertaken by approximately 15 "W" licensed vessels in Prince Rupert harbour and in Masset Inlet. Fishing in these areas opens on the same date as the trap fishery for prawns on the remainder of the coast. However, the fishing opportunity continues past the coast wide closure for prawn fishing, until the calendar year end. Humpback shrimp are also taken and retained as an allowable incidental catch in the prawn fishery, but may not be specifically targeted for harvest. When this has occurred in the past, trap fishing in those coastal areas has been closed.

4.3.3.1. Current Humpback Shrimp Trap Fishery Management Issues

Stock size is unknown. There is no spawner index established for this species, to determine when closures should be put in place. There are no catch limits. Minimum mesh size requirements to match the prawn trap fishery requirements were adopted in 2000. With the pilot program area licensing in 2000, this fishery was open to "W" licence holders who chose to fish northern and west coast Vancouver Island waters, only.

Humpback shrimp are also taken as bycatch in the shrimp trawl fishery. There are some locations where trawl fishing continues to harvest humpback shrimp even though they are closed to trap fishing. It makes little sense to exclude the more selective fishing gear from harvesting opportunities, or even from scientific licence opportunity to collect additional biological information, while stocks continue to be subject to harvesting by a less selective gear type.

4.3.4. Commercial Coonstripe Trap Fishery

The commercial coonstripe trap fishery occurs as a directed fishery in November and December in Sooke Harbour and Sooke Basin in Juan de Fuca Strait. Approximately 3 vessels participate in this fishery annually. Vessels are limited to 50 traps in this fishery. Single buoyed lines are permitted.

4.3.4.1. Current Coonstripe Shrimp Trap Fishery Management Issues

Stock size is unknown. Biological information is lacking. There is no spawner index established for this species. There are no catch limits. The limited fishing ground, low trap limits and time of year discourage excess participation. It is largely a fishery by locally resident "W" licence holders.

4.3.5. Recreational Shrimp Trap Fishery

4.3.5.1. Recreational Fishery

The recreational fishery for prawns and shrimp is open coast wide throughout the year. A British Columbia Tidal Waters Sport Fishing Licence is required to harvest prawns and shrimp using recreational trap gear. Regulations are summarized annually in the British Columbia Tidal Waters Sport Fishing Guide which is available free of charge from licence vendors or the Department, and can be found on the Fisheries and Oceans Canada Pacific Region web site.

This is an unlimited entry fishery. There were approximately 280,000 recreational fishers in British Columbia in 2000 who held recreational licences which includes the entitlement to harvest prawns and other shrimp.

All species of shrimp are permitted to be harvested by trap by recreational fishers. Fishing is primarily on prawns, which are the largest shrimp species on the coast. Humpback shrimp and coonstripe shrimp may also be taken by recreational traps.

In practice, participation is limited to those persons who have vessels, appropriate gear and access to prawn and fishing grounds. There is no estimate of the actual number of recreational fishers who harvest prawns. Effort on prawns was low until the mid 1990's when two changes took place. Gear restrictions were relaxed permitting the use of hydraulic and electric winches (haulers, pullers) to recover sports traps set in deep water. Also, the decline in the salmon fishery and in rockfish stocks led to greater attention to other recreational fishing opportunities.

The recreational fishery occurs primarily near population centres. There are concentrations of sports fishing effort in Saanich Inlet, Stuart Channel, in the Quadra and Cortes Island areas of northern Georgia Strait, near Powell River, in Howe Sound, on the west coast of Vancouver Island in Alberni Canal, and in the central coast at Kitimat and in Kildala Arm.

Management measures for the recreational fishery include gear limits, gear marking requirements, a daily catch limit and a 2 day possession limit. Recreational fishers are limited to 4 traps per fisher. There is no minimum size for caught prawns, nor any mesh size requirements on the traps. In practice, this results in the catch of large numbers of small prawns. Daily limits are 5 kg. whole or 2 kg. with the head removed. Possession limits are twice the daily limit.

There are no logbook or catch reporting requirements. Creel survey information is insufficient to characterized recreational prawn fishing effort.

There is no estimate of recreational fishery economic values.

There is no estimate of the Departmental contribution for management or enforcement of the recreational fishery. Department contributions include recreational licence distribution and records, attention to issues and meeting participation by Recreational Fishing Area Co-ordinators, including attendance at Sports Fishing Advisory Board Groundfish and Shellfish Subcommittee Meetings, and enforcement personnel patrol of recreational fishing grounds, responding to public reports of illegal harvesting, surveillance, unmarked gear seizures and legal proceedings.

Recreational fishing representatives have participated in the Prawn Sectoral Committee since 1998.

4.3.5.2. Recent and Current Initiatives

Winter Spawner Index Surveys and Recreational Closures, 1999/2000

In the fall of 1999, commercial licence holders were invited by the Department to put forward proposals for scientific licence surveys to collect winter spawner index information, or to undertake comparative trap testing. Approximately 14 licences were issued. The spawner index was found to be below the monthly reference level in Homfray/Pryce/Lewis Channels near the Redonda Islands in the northern Gulf of Georgia. Recreational fishing closures were announced for March and early April, to allow the remaining spawners to complete egg incubation and release larvae. These were the first recreational prawn fishing closures on the coast.

Attempts to continue this program in 2000 were stymied by licence holder disagreements with the terms of the program for availability of licences and requests for changes in sampling periods to accommodate personal interests. As well elected industry representatives voiced concern for representation on the Research Subcommittee. Accordingly, the program was suspended. Only one area was tested, Saanich Inlet, which was found to be above the target index.

The sampling program will be re-established in 2001/2002 by the Stock Assessment Division, with advice from a Research Subcommittee.

Recreational Fishers and Spawner Index Monitoring

The Sports Fishing Advisory Board representative of the Prawn Sectoral Committee has begun work with several prawn fishers who fish on a regular basis, to undertake spawner index monitoring in the fall and winter. This will familiarize recreational fishers with the spawner index as a conservation measure and provide fall and winter index information to the Department. It also demonstrates that catch quality can be improved with large mesh traps.

Daily Catch Limits and Possession Limits Reg. Changes

Daily catch and possession limits are presently set on the basis of weight. This is difficult for fishers to assess during fishing, and is difficult for enforcement personnel, as it requires use of a verified weigh scale under field conditions. A recommendation for conversion to a 200 piece count daily catch limit was made to the Groundfish and Shellfish Subcommittee of the Sports Fishing Advisory Board in January 2000. The 200 pieces was based on the 5 kg. daily catch limit, and a commercial fishery average of 40 medium prawns per kilogram.

Conversion to a piece count will encourage fishers to target larger prawns. However, this measure may also promote catch high grading, that is, discarding of dead small catch when larger catch is encountered.

Buoys and Groundlines

Other changes discussed and supported by the SFAB Groundfish and Shellfish Subcommittee includes requiring the fisher's name on the marker buoys instead of the trap owner's name which is presently required, and limiting the number of traps that may be set on a single groundline.

Information for Recreational Prawn Fishers

A 5 page pamphlet of information and advice for recreational prawn fishers is provided on the internet, and mailed on request. It includes recommendations for gear management and conservation based fishing practices.

4.3.5.3. Recreational Trap Fishery Issues

The main issues regarding recreational fishing effort increases are the lack of information about the effort in this fishery, poor trap identification regulations, catch limits which are difficult to accurately assess in field conditions, lack of minimum mesh size for trap gear to improve bottom sorting of small prawns, lack of a minimum size limit, lack of seasonal closures to protect berried prawns, and lack of spawner index monitoring at times when the commercial fishery is closed.

Increasing Effort

There has been a substantial increase in recreational fishing effort on prawns in the past 5 years. At the same time, the timing of the commercial fishery has been reduced to 3 months in late spring, early summer. Spawner index information is collected primarily during the commercial fishery, leaving 9 months of little information about stock status.

Concerns are being expressed by recreational fishers and by First Nations about the increased level of recreational prawn fishing in Saanich Inlet during fall and winter periods.

Recommendation: Work with recreational fishing representatives to establish a system of spawner index testing in fall and winter in areas of significant recreational fishing effort; where possible, provide opportunities for recreational fishing representatives to work with commercial harvesters who are also engaged in fall and winter index testing in areas of common interest.

Winter Closures

Annual winter closures were first introduced in the commercial fishery to protect incubating adult female prawns from fishing disturbance during the January to March incubation period. Recreational fishing effort has increased substantially in some coastal areas in the past 5 years so that there is considerable effort even in winter. There is insufficient testing to determine the effect of this late season fishing on the stocks.

Recommendation: A precautionary approach suggests that January to March closures should be considered for coastal areas with high levels of winter recreational prawn fishing activity, particularly if there is no index testing to demonstrate that recreational catches are sustainable above the target spawner index levels. Co-ordinate this with fall and winter index testing programs, where they exist.

Mesh size

There is no minimum mesh size for recreational prawn and shrimp traps. Consequently, large numbers of small prawns are caught by this gear. If released, these prawns are subject to hauling, handling and release mortality. With the change to a piece count, prawn fishers will preferentially keep larger prawns, which will increase the release and incidental fishing mortality on small prawns.

Recommendation: Begin discussions with the SFAB Groundfish and Shellfish Subcommittee on the phased introduction of minimum mesh size requirements for recreational prawn traps.

Lack of Catch Data

There is insufficient information about the amount of recreational prawn fishing effort and catch.

Recommendation: Ensure that the committee presently working on catch reporting is aware of the need for improved data in the recreational prawn fishery.

4.3.6. First Nations' Shrimp Trap Fishery

4.3.6.1. Domestic Fishery (FSC)

There are 53 coastal First Nations. There are First Nations fisheries for food, social, and ceremonial purposes occurring near Powell River, Saanich Inlet and Bella Bella. Other First Nation fishing activity is alleged to occur near Kyuquot and Beaver Cove near Port Hardy.

First Nations access to fish for food, social, and ceremonial purposes is managed through a Communal Licence. Communal Licences are issued to Aboriginal organizations through the Department's Aboriginal Fisheries Strategy pursuant to Section 4 of the *Aboriginal Communal Fishing Licence Regulations,* pursuant to the *Fisheries Act*, and can permit harvest of shellfish, including prawns and shrimp. Communal Licences include a mechanism for designating individuals and vessels to fish under the authority of that licence. Communal Licenses outline the terms and conditions for harvesting pursuant to the licence and specify Pacific Fisheries Management Areas for harvest. Catch monitoring and reporting requirements are outlined in the fisheries agreement and/or Communal Licence. Communal Licenses can be amended in-season for resource conservation purposes.

4.3.6.2. Current Management Issues

Lack of catch reporting is the most important issue for this fishery. Other issues include unlimited gear quantities, lack of mesh size requirements, lack of a minimum size limit and FSC fishing occurring in areas where the spawner index may be low.

4.3.7. Stock Status

4.3.7.1. Assessment

Stock strength is assessed on the basis of a biological reference point, the spawner index. The spawner index is the measure of the number of female or transitional prawns that will be reproductively mature by the fall and winter of that year, caught in a standard trap fished for 24 hours. The index was initially established based on conditions in Knight Inlet stocks that historically proved to be sustainable in the face of strong annual fishing effort (Boutillier and Bond 1999).

Prawn stocks are assessed during the commercial fishery season by trained observers sampling on board commercial vessels during trap hauling. The extent of the in-season sampling has increased significantly since 1995 due to increased resources provided by industry. However, the season has become progressively shorter from 276 days in 1994 to 79 days in 2001. With the shorter commercial season, most spawner index sampling is now confined to a small portion of the year. As a result, most sampling now occurs prior to the final adult moult so that stock conditions are not assessed following the mortality associated with this life stage event.

All prawns from every second or third trap on a string of 50 traps are collected. The prawns are segregated by life stage, counted and weighed, and the trap type is noted. This raw data is returned to the Stock Assessment Division. Preliminary counts are adjusted for trap efficiency, which varies from 0.8 to 1.7 compared to a standard trap design. All females are counted, as well as prawns in a transitional sexual state that will become reproductively mature females that year. The average count of females and transitions is compared to a biological reference point, the spawner index which is the number of females that are considered necessary to meet reproductive requirements for conservation of the stock. Ideally, samples are considered from traps that have soaked for 24 hours. However, results from shorter or longer soaks will also be considered if data for a given coastal area is limited. When the spawner index in the samples collected during the commercial fishery season has declined and is approaching the reference number, the commercial fishery is closed in that harvest area.

In 1999, 1224 spawner index samples were collected by 11 charter patrol Guardians, representing data from more than 21000 traps during the 78 day commercial fishing season sampled with 506 charter vessel days. In 2000, 1214 spawner index samples were collected from a slightly greater number of traps, during the 85 day fishing season, sampled with 503 charter vessel days. In 2001, 1358 spawner index samples were collected by 11 service company patrol vessels, representing data from more than 23,000 traps during the 79 day commercial fishing season sampled with 492 patrol vessel days.

4.3.7.2. Research

There is a long-term research project in Howe Sound in the Strait of Georgia. Prawn abundance surveys are undertaken in this area twice yearly, in the fall (October) and winter (Feb-Mar). On occasion, trap efficiency comparison testing is also undertaken in conjunction with this survey. This area has provided some unique opportunities for study. A portion of the area was closed to prawn harvesting in the early 1990's due to dioxin and furan contamination, which allowed comparison of stock characteristics in harvested and non-harvested zones. The area was re-opened when dioxin contamination declined, but stocks were then exposed to a disease outbreak. Studies in Howe Sound were summarized in a Pacific Science Assessment Review Committee working paper in 1996 (Boutillier 1996).

4.3.8. Consultative Process

The primary consultative body is the Prawn Sectoral Committee. The terms of reference for this committee may be found at:

http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/Prawn/term_ref.htm.

This advisory committee includes representatives from Fisheries and Oceans Canada, BC Ministry of Fisheries, elected representatives of commercial licence holders, and appointed representatives of buyers, First Nations fishers who participate in the commercial fishery, other First Nations representatives, the Sports Fishing Advisory Board representing recreational fishers, and the Coastal Community Network.

There are two main meetings of the Prawn Sectoral Committee, annually. The post-commercial season review occurs in September. The second fall meeting considers commercial harvesting plan changes for the following fishing season. Recreational and First Nations fisheries issues are raised and considered in these meetings. Other meetings are added as required. Subcommittees are established as required (e.g. Logbook, Future Management Options) and dissolve when work is complete. A Research Subcommittee is established at present.

4.3.8.1. Record of Meetings

Sept. 1999 Prawn Sectoral Committee post-commercial season review. DFO tables a proposal for a single haul management feature for the 2000 fishery.

Jan.9, 2000 Sports Fishing Advisory Board, Groundfish and Shellfish Subcommittee. Proposals for a piece count instead of a weight limit, and for a maximum number of traps on a string are tabled and forwarded to the Board.

Jan.12, 2000 Prawn Sectoral Meeting; 2000 commercial harvest plan discussions.

Feb.1, 2000 Prawn Sectoral Meeting; 2000 commercial harvest plan discussions.

Feb.24, 2000 Prawn Sectoral Meeting; final negotiation of management plan features for the 2000 commercial fishery.

Apr.4, 2000 DFO pre-season Guardian and Enforcement Meeting.

Aug.14, 2000 DFO/caucus meeting regarding Dr. Levings' trap/trawl study, and partial fishery proposal to the NTC.

Sep.25, 2000 Federal Treaty Negotiations Office meeting with industry representatives regarding the partial fishery proposal to the NTC.

Sept.26, 2000 2 day meeting. Prawn Sectoral Committee post-commercial season review followed by general industry meeting to discuss future management options.

Oct.26, 2000. Industry caucus meeting with DFO regarding single haul enforceability.

Nov.15, 2000. Research Subcommittee meeting to develop criteria for winter index and trap testing surveys.

Jan.29, 2001. Industry caucus meeting with prospective service provider companies.

Feb.xx, 2001. DFO meeting with Sports Fishing Advisory Board, Groundfish and Shellfish Subcommittee.

Mar.6, 2001. DFO discussions with industry caucus regarding collaborative agreement.

Apr.18, 2001. Two day training session for industry observers.

Jun.19, 2001. DFO meeting with fishers and buyers in Powell River regarding coliform bacteria.

Sep.21, 2001. Prawn Sectoral Committee post commercial season review, followed by general meeting on coliform bacteria issue.

4.3.9. Objectives

Statements of long term (strategic) objectives for the commercial fishery by Fisheries and Oceans Canada and by Industry, for the recreational fishery, for First Nations food fisheries, and for aquaculture are found in the supplementary information document for the integrated fisheries management plan. This supplemental information document is posted on the internet, and can be provided on request of any Fishery Management Biologist or Co-ordinator.
Multi-year (tactical) objectives are as follows:

4.3.9.1. Spawner Index Studies

Co-operative programs with industry associations, with the Sports Fishing Advisory Board, and with First Nations will be considered to provide additional spawner index sampling information at those times of the year when the commercial fishery is closed, to better characterize when egg incubation is occurring and to ensure that mortality rate characteristics as assumed in the spawner index model are valid.

4.3.9.2. Partnering with Industry

Commencing in 2001, the elected Industry representatives have a greater role in development of the commercial harvest plan. They may design the commercial fishing plan provided they meet requirements and expectations for conservation, obligations to First Nations for access for food, social and ceremonial purposes, licence holder buy-in, enforcement, and cost neutrality to the Department.

The Department will continue to work with a representative industry association in the development of collaborative agreements to support program delivery.

4.3.9.3. Recreational Fishery Changes

Regulatory changes will be requested to change recreational fishing limits from a weight to a piece count, and to limit the number of traps set on strings (bottom lines).

4.3.9.4. First Nations Objectives

The Department will consider and encourage development of co-operative arrangements for spawner index testing.

The Department will consider the development of treaty related measures (TRMs), which may be implemented in conjunction with Agreements in Principle.

4.3.9.5. Exploratory/Experimental

Department Stock Assessment Division studies of prawn stocks in Howe Sound will continue.

A Research Subcommittee has been established including the Department and Sectoral Committee representatives. The Subcommittee will develop a process for fall and winter spawner index assessments, for trap efficiency testing, for demonstration fisheries for the public, and for other activities considered to be of value to the management of the prawn fisheries.

Further development of harvest opportunities on humpback shrimp will be undertaken in terms of the "Framework for New and Developing Fisheries".

4.3.9.6. Aquaculture Objectives

No specific objectives have been defined for prawn aquaculture. There are no prawn aquaculture activities underway at present (Dec. 2000).

4.3.10. Enforcement

4.3.10.1. Illegal Prawn Sales, Bootleggers and Poachers

"Bootlegging" refers to the illegal sale of prawns caught under the authority of a recreational or First Nations' communal fishing licence. The ability to purchase out of season fresh prawns in bars and at restaurants is well known, but difficult to investigate and prosecute. Some commercial vessels report extraordinarily high landings early in the season, above levels considered to be reasonable for the available time since opening. Some shrimp trawl vessels retain illegally retain prawns during closure periods or retain more than the allowable incidental catch during the open season. Five of these vessels were successfully prosecuted in October 1999, resulting from one investigation that summer. Illegal fishing may be affecting conservation requirements in some areas.

4.3.10.2. Industry Funding of Enforcement Efforts

The 2000 – 2001 management plan marked the last fishing season in which fishers paid all operational costs including enforcement funds directly to the Department. Each fisher paid a $1470 management fee in addition to the $320 licence fee. Of the total amount collected, 25K was made available to C&P for enforcement of the single haul condition of licence, first put in place as a pilot project in 2000. Enforcement funding doubled the following year (2001) when the single haul management measure was adopted and extended coast wide.

4.3.11. Sustainable fisheries

Expectations or forecasts are not made pre-season for the commercial prawn fishery, as prawns are a short lived species (4 yrs) exhibiting highly variable recruitment from year to year and area to area, likely reflecting the impact of environmental conditions on larval and juvenile mortality rates. The prawn fishery season length had declined from 195 days in 1995 to 79 days in 1999. Season length was anticipated to be 70 to 85 days for the 2000 season. Prawn landings had peaked at 1785 tonnes in 1997 and declined to 1463 tonnes in 1999. It was not known if the years preceding 1999 represented a recruitment event followed by a decline to landings representative of a longer term average, or if 1999 has declined as a result of environmental changes. Anomalous high water temperatures and low plankton abundance were reported anecdotally in the spring of 1999, and a review of long term salinity variation in the Gulf of Georgia suggested a period of increased fresh surface water during the prawn larval stage in 1996. Offsetting the concern raised by reduced production in 1999, was the series of more conservative fishing measures that had been adopted by the commercial fishery throughout the period from 1995 to 1999: adoption of precautionary decision rules for in-season closures, increased in-season sampling by biological monitors, improved closure timeliness, increased size limits, later season opening, release of berried prawns, and management coast wide to a higher in-season spawner index target. The outcome was that the year 2000 fishing season was 85 days in length, with landings of 1748 tonnes.

4.3.11.1. Effort & Capitalization

The commercial prawn fishery is intense, but considered to be sustainable. In FAO terms, it is overcapitalized. 250 vessels complete the harvest in approximately 3 months, after which many of the vessels are idle. Presumably, the prawn fishery could provide a 9 month fishery excluding 3 months for protection of the final brood stage for berried females, for approximately 80 vessels. The surplus in vessels was primarily established in the licence limitation process of 1990. The initial criteria qualified 125 vessels. The number of eligible licences increased to 260 through the Licence Appeal Board process. Effort in the fishery was substantially increased in the mid 1990's when salmon fisheries declined. Approximately 100 vessels were licensed for both prawn and salmon fisheries, and became full time prawn fishing boats at that time. Trap limitation succeeded in constraining capitalization into additional gear. However, within several years, licence holders were reinvesting fishing profits in new vessels, engines and in refitting vessels including widening hulls and added stern platforms to increase trap carrying capacity.

Effort and harvest efficiency has increased in the past 5 years. Effort increased by the adoption of multiple hauling, after trap limits were introduced. Efficiencies increased by widespread introduction of GPS positioning equipment and by introduction of new trap designs with greater catching power.

4.3.11.2. Selective Fishing

Bycatch is considered to be of limited concern due to low quantities and the ability to release most bycatch unharmed. Bycatch includes some crab species, sea stars, occasional bottom fish and octopus. Fishers can retain octopus, by requesting an octopus endorsement in their conditions of licence, which requires increased commitments for reporting biological information about octopus catch.

4.3.11.3. Habitat Impacts

Habitat impacts are related to gear set on bottom lines, dragging on the bottom during recovery. This is likely to have a low impact in rocky areas, but may adversely affect coral beds and sponge communities that are also a preferred habitat for prawns.

4.3.11.4. Food Web Linkages

Prawns are opportunistic foragers, consuming fresh, moribund or dead organic material. Stomach contents of prawns near Vancouver held remains of polychaete worms and unidentified crustaceans. Cannibalism was noted in aquaculture attempts to grow out juveniles.

Prawn larvae are prey items for other pelagic and planktonic marine organisms. Juvenile and adult prawns are prey items for bottom fish and octopus. Increased prawn abundance may have resulted from fishing down groundfish stocks. Prawn harvesters may retain octopus, an approach that simultaneously fishes both the prey and a significant predator.

4.3.11.5. Code of Conduct

No specific code of conduct has been developed for this fishery.

4.3.11.6. Coastal Communities

There are presently 252 "W" licence holders who reside throughout the coast. There are 20 licence holders in north and central coast communities, 120 on the east coast of Vancouver Island including Victoria, and more than 60 on the Sunshine Coast. Overall, more than 84% of prawn licence holders live in smaller coastal communities outside of major metropolitan areas. 'It is likely that their incomes make an important contribution to local economies.

Prawn fishing is enjoyed by recreational fishers in several coastal community areas, notably Saanich Inlet, Stuart Channel (Ladysmith, Crofton, Chemainus), Port Alberni, Campbell River, Powell River, Howe Sound and Kitimat.

Prawn fishing is pursued by First Nations in coastal communities in several areas; Saanich Inlet, Powell River, Beaver Cove, Kyuquot, and Bella Bella.

4.3.12. Additional notes

4.3.12.1. Financial Responsibilities

Fisheries and Oceans:

An estimate of the Department's total program costs in the commercial fishery was last prepared in 1997, in support of a request for a Treasury Board agreement for the collection of management fees from licence holders. At that time, total annual program costs for the Department were estimated at $232,600, consisting of salaries, goods, services and vessel time in management biology ($72 K), Science stock assessment ($116 K), enforcement ($26 K) and other support ($19 K). This did not include smaller amounts that might be incurred by aquaculture, Aboriginal Fisheries Strategy, Finance, National Headquarters in Ottawa and other sections. No current estimate is available, but program conditions have not changed significantly.

Industry:

Commercial Licence (Access) Fees

The annual commercial licence fee is $320. This is also referred to as the "access" fee. This fee was last revised in 1996, based on records of landed values in the fishery in the preceding 3 years. Although a review of access fees has been mentioned several times since then, it has not yet occurred and no change to this fee is scheduled at present.

Management Fees

With the introduction of trap limits in 1995, commercial licence holders paid an additional fee for management, stock assessment and enforcement. The additional fee was $1135 per licence from 1995 to 1997 and $1470 per licence from 1998 to 2000. These funds were used for charter patrol vessel contracts (75%), for in-season management and stock assessment (15%) and for trap tags, the hail line and contingencies. In 2000 the funds were also used to support Department enforcement in the single haul pilot program in southern waters. For the period 1995-2000, these fees were set by regulation, collected by Department personnel at the time of licence renewal, and returned to the Department for use under the terms of a Treasury Board agreement. In the final year of the program, this arrangement provided $368,000 for prawn fishery delivery.

The Department prefers to have access fees separate from any additional costs associated with management of the fishery. Accordingly, this method of funding the in-season management of the fishery was discontinued in March 2001.

As of April 2001, a large part of the program information delivery requirements and associated costs became the direct responsibility of the individual licence holders by conditions of licence requiring various types of information delivery. Licence holders are now responsible to make their own arrangements with a private sector service company which provides trap tags, on-board gear and record inspections, spawner index sampling and vessel activity hail information. Information delivery occurs by means of an internet web page that allows registered service companies to directly deposit data for storage in Departmental data bases, and by electronic file transfer of spawner index data. Licence holders are required to provide a letter to the Department at the time of licence renewal to indicate that they have made arrangements for in-season information delivery from a service company.

The changes in licence conditions accounted for approximately 85% of the program delivery costs previously provided by collection of management fees. The remainder of the program delivery costs are salary costs for term employees which provide in-season attention and delivery of the management and stock assessment functions including fleet effort tracking and spawner index data management. In 2001 a collaborative agreement with a representative industry association provided $35,000 for these functions, and $50,000 for coast wide in-season enforcement support for the single haul limit. The industry association collected the additional funds for the collaborative agreement, by voluntary donation from more than 90% of the licence holders. However, inequities were established as not all licence holders contributed to this funding, and there are concerns about potential erosion of future participation in the voluntary contribution program.

Logbook Fees

Licence holders are required to provide paper copy and electronic copies of logbooks to the Department. They may do so directly, or may make arrangements with a private sector company for delivery of the logbook data to the Department. Approximately 6 of the 214 vessels active in the 2001 fishery provided their own logbook data. The remainder made arrangements with one of 2 service provider companies for information delivery. Fees were approximately $134 for logbooks in 2001.

4.3.12.2. Elections and Licence Holder Associations

Elections for licence holder representatives on the Prawn Sectoral Committee were held in Sept. 1999, for a 2 year term. Eight representatives were elected for 6 licence holder associations. The Department runs the elections. The election process is described in the Committee's terms of reference which are available on the Department's prawn fishery information page on the internet, at:

http://www.pac.dfo-mpo.gc.ca/ops/fm/shellfish/Prawn/term_ref.htm

Elections in 2001 are underway. 86% of licence holders returned ballots, electing 12 representatives of 8 separate industry associations.

4.3.12.3. Licence/ Vessel Values

In 2001, the market value for a "W" licence eligibility and vessel was $10,000 to $12,000 per foot of vessel length.

Licences were leased for fishing and for trap transfers (licence stacking). Lease costs in 2001 were reported to be $30,000 to $40,000.

4.3.12.4. Licence Holder Participation in Other Fisheries

Licence records were inspected in June 2001, to assess "W" licence holder participation in other fisheries. The 252 "W" licence holders also held other licences as follows:

AG	salmon gillnet	8
AS	salmon seine	1
AT	salmon troll	37
CA	schedule II hook and line	4
K	sablefish (black cod)	2
L	halibut hook and line	26
R	crab	19
S	shrimp trawl	11
T	groundfish trawl	2
ZD	sea cucumber dive	2
ZL	surf and pile perch	1
ZNI	rockfish hook and line, inside	1
ZNO	rockfish hook and line, outside	7
ZX	herring bait	1

In 1995 there were more than 100 salmon licences held by "W" licence holders. This would usually result in a mid-season reduction in prawn fishing effort, as vessels left to participate in the salmon fishery. With the decline in the salmon fishery beginning in 1996, and the licence buy back program which followed, there are now only 46 "W" licence holders which also hold a salmon licence, mostly troll. In 2001, the prawn fishery was closed July 18 while the Fraser sockeye fishery was anticipated in late July and early August. These types of factors can influence late season participation, as well as the anxiety some fishers may express to have the prawn fishery close before salmon opportunities commence.

4.3.12.5. "W" Licence Concentration

Some licence holders hold eligibility for more than one "W" licence. In August 2001, there were 20 licence holders that held 2 "W" licences, 8 that held 3 licences, 1 that held 4 licences and 1 that held 5 licences. In total, there were 179 "single" licence holders and 30 "multiple" licence holders who collectively held 73 licences.

4.3.12.6. Company and Corporate Ownership

In August 2001, there were 121 licences held in company or corporate names, and 127 held in the names of individuals. Fisheries and Oceans Canada held 4 licences for distribution to First Nations as communal commercial licences. Note that "company" ownership often represents single proprietorship arrangements by individuals who have taken this step for business purposes.

4.3.12.7. Licence Ownership Changes

Licence ownership is relatively stable (December, 2001). Ownership history was compared between end of year 2001 and 2000. Ownership changes were noted for 14 of the 252 licences. Of these, 5 included conversion from personal proprietor to limited company status, or changes in names with no changes in the principle signing officers for a company. Several other changes represented licence eligibility exchanges among existing members of the fleet. Only 6 changes appeared to represent persons new to the eligibility list.

4.3.12.8. Trap Allocation Stacking

Trap "stacking" began with the introduction of trap limits in 1995. Decided by industry ballot, vessels were permitted to transfer a trap allocation from one vessel onto another in which case the donating vessel does not fish during the season. However in doing so, only 450 traps of the two vessel total of 600 traps, could be fished on the second vessel.

There were 34 stacked licences in 2000. Stacked trap vessels electing to fish inside of Vancouver Island were permitted to fish 450 traps. Stacked trap vessels electing to fish on the west coast of Vancouver Island and further north were permitted to fish 500 traps as an incentive for selecting these areas in the pilot area licensing program. In 2001 there were 36 vessels fishing stacked trap allocations. As single haul was in effect for the entire coast and there were no area licensing provisions, all stacked trap vessels were permitted to fish 500 traps. The 500 trap stacking level was controversial. When an industry ballot early in 2001 on the question of the number of traps that should be permitted resulted in a dead even tie vote, the Department implemented 500 traps as recommended by a majority of the elected industry representatives of the Prawn Sectoral Committee.

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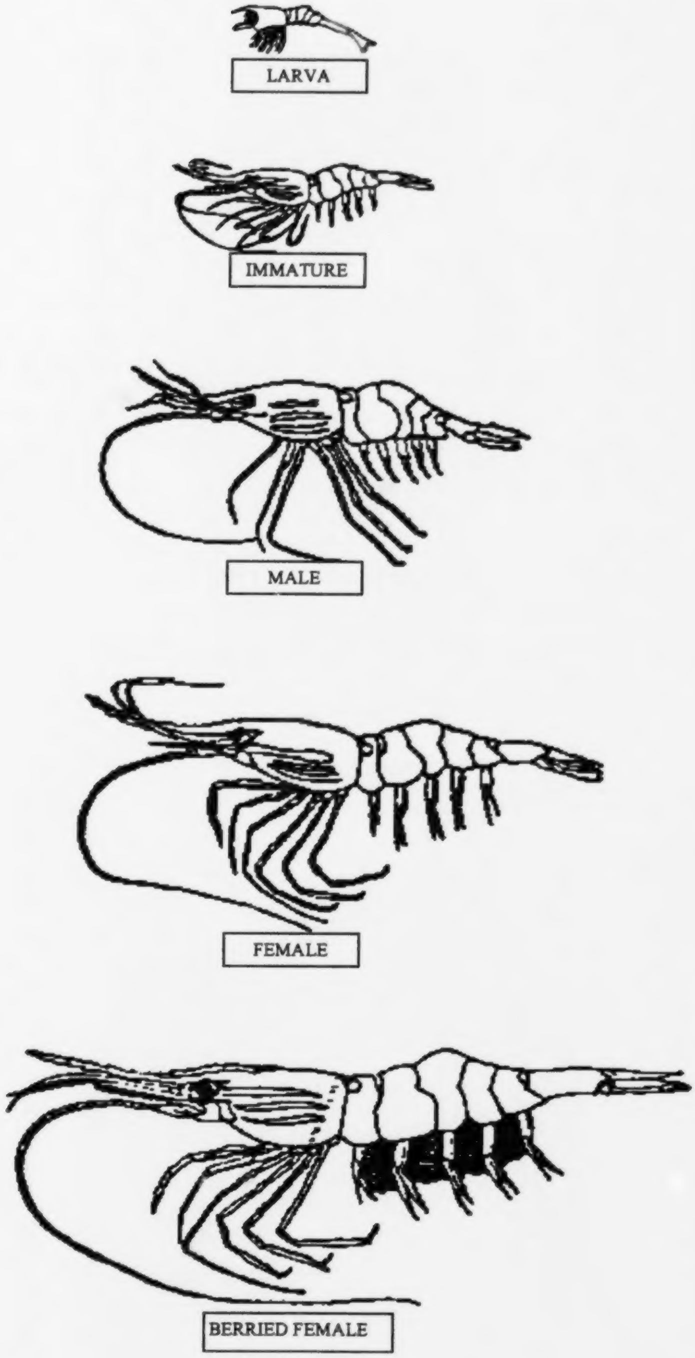


LARVAE HATCH IN MARCH - APRIL IN ADULT HABITAT OF 70 - 90 M.

FIVE LARVAL STAGES OVER 2 - 3 MONTHS

LARVAE SETTLE IN SUMMER. FOUND IN SHALLOWER REGIONS < 54 M.

12 MONTHS; 21 MM CARAPACE LENGTH (C/L); 6.5 GRAMS (g).

BACK ON ADULT GROUNDS. 18 TO 24 MONTHS.

MATURE AND FUNCTION AS MALES.

24 MONTHS; 33 MM C/L; 23 g

24 TO 30 MONTHS, REPRODUCTIVELY MATURE MALES SPAWN

30 TO 36 MONTHS TRANSFORMING FROM MALES TO FEMALES (TRANSITION PHASE)

FEMALES BY 36 MONTHS.

EGGS CARRIED (2000 TO 4000) BY FEMALE FOR ABOUT 5 MONTHS.

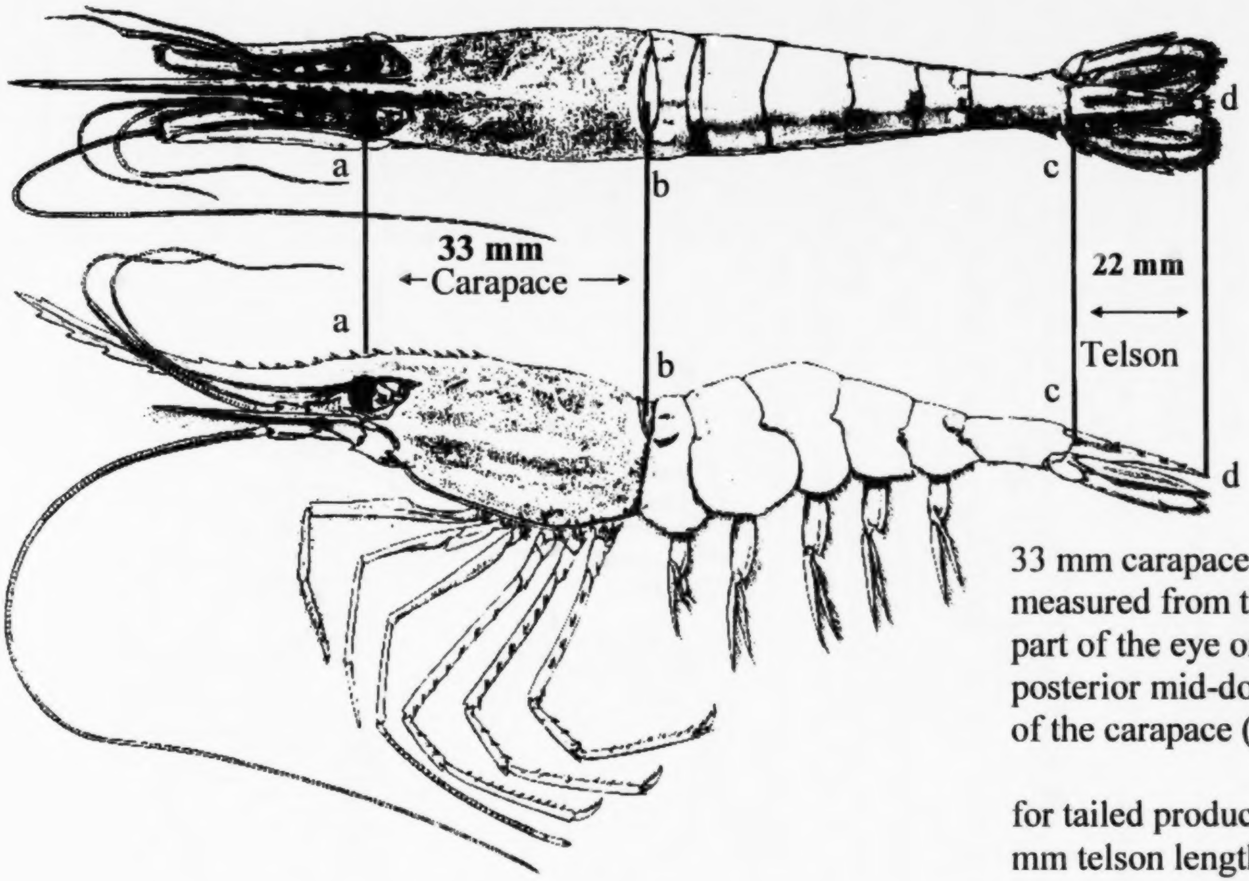
AUTUMN BREEDING. SPAWNING COMPLETE AT END OF OCTOBER (VARIES GREATLY FROM AREA TO AREA)

48 MONTHS; 38 MM C/L; 35 g.

AFTER SPAWNING HIGH MORTALITY. FEW SECOND SPAWNERS.

Figure 4.3.6. Prawn Life History

Figure 4.3.7. Prawn Commercial Size Limits


a
b
c
d
33 mm
← Carapace →
22 mm
←→
Telson
a
b
c
d

33 mm carapace length as measured from the posterio part of the eye orbit (a) to t posterior mid-dorsal margi of the carapace (b).

for tailed product only, 22 mm telson length (c) to (d).

Figure 4.3.8. Prawn Trap Examples

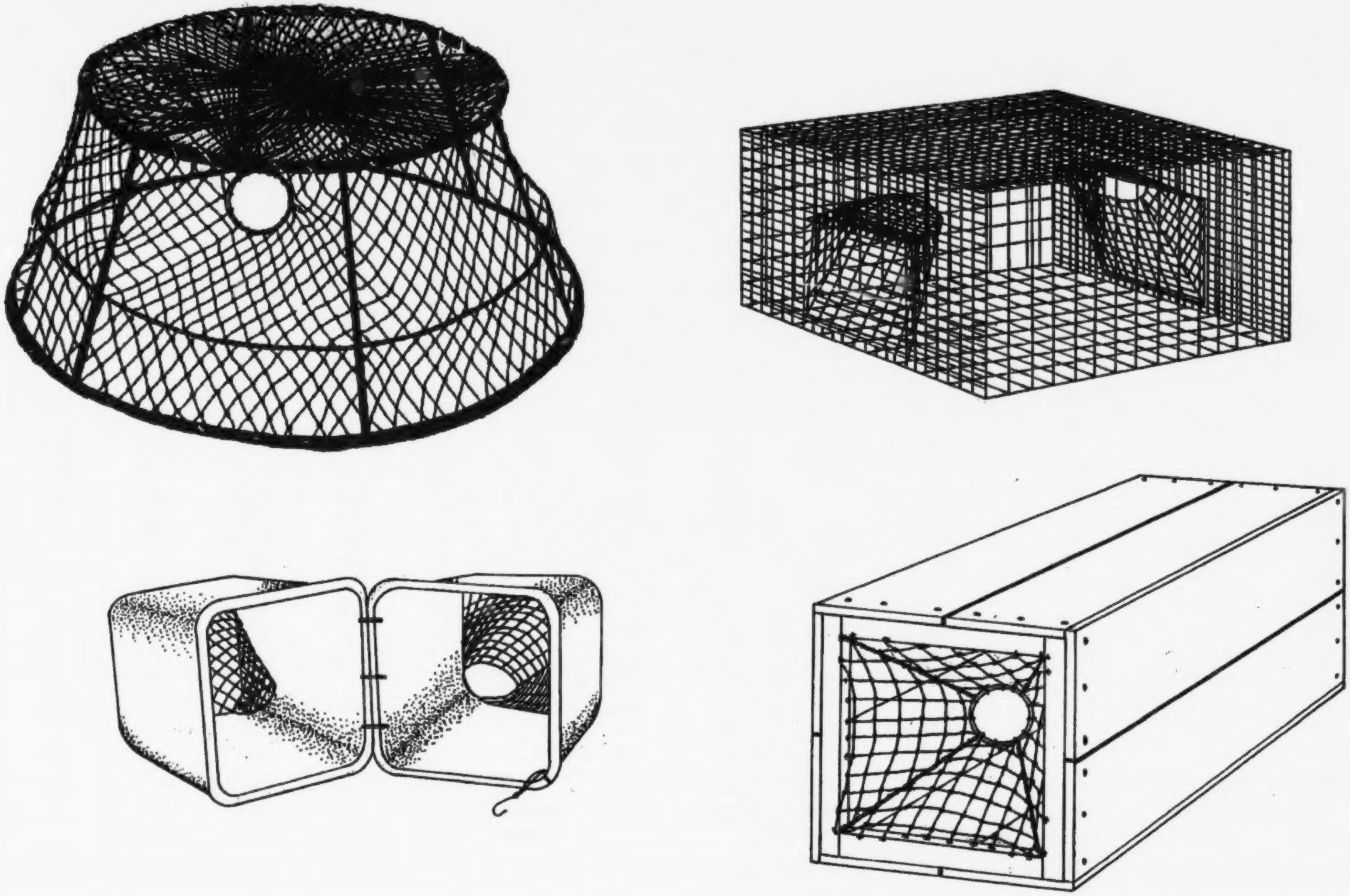


Table 4.3.2. Prawn trap fishery landings in tonnes and effort, 1982 to 2000.

Year	Number of Licences Issued	Vessels with Landings[c]	Fishing Days[c] (10^3)	Ave. Fishing Days per Vessel	Season Length	Landings[c] (t)	Landings t/day	Landed Value[a] ($\$x10^3$)	Landed Value ($/kg)	Mean CPUE[b] (kg/vessel*day)	No. of Traps Hauled[b] (10^3)	Mean CPUE (kg/trap)
1982	–	218[d]	7.2			264	36	1,633	5.96		–	–
1983	567[d]	276[d]	7.6			325	43	1,639	4.95		1,618	0.26
1984	633[d]	305[d]	9.1			378	41	3,262	4.58	46	2,136	0.24
1985	544[d]	241[d]	10.3			509	49	2,440	4.79	55	1,969	0.26
1986	551[d]	203	10.3	51		543	53	3,696	6.81	57	2,089	0.26
1987	698[d]	236	12.9	55		616	48	4,303	6.98	56	2,496	0.25
1988	677[d]	262	13.0	50		714	55	5,837	8.17	56	2,887	0.25
1989	901[d]	298	16.5	55		805	49	6,968	8.66	51	3,665	0.22
1990	249	202	14.7	73		757	52	6,979	9.22	62	3,284	0.23
1991	261	227	19.2	85		954	50	7,683	8.05	63	3,493	0.25
1992	263	223	19.9	89		1,166	59	9,397	8.06	75	4,098	0.31
1993	257	232	18.5	80		1,211	65	10,095	8.33	80	3,924	0.31
1994	257	228	21.1	92	230	1,307	62	12,126	9.28	77	4,851	0.27
1995[e]	253	221	17.9	81	195	1,329	74	17,717	13.33	74	4,789	0.28
1996[e]	253	222	18.3	82	123	1,715	94	26,628	15.21	94	5,288	0.32
1997[e]	250	226	16.4	73	106	1,785	109	26,329	13.22 - 19.84	109	5,222	0.34
1998[e]	251	228	16.3	71	93	1,734	106	19,535	9.22 - 14.17	119	5,479	0.32
1999	250	230	13.4	58	79	1,462	109	18,814	13.07	109	4,538	0.32
2000	251	215	13.5	63	85	1,748	129	29,192	18.75	130	4,501	0.39

This table was amended in 2000 to reflect trap data only and to verify all figures. Accordingly, values will differ from those published in previous fishery updates.

[a] from fish slips

[b] from harvest logs

[c] data from 1982 to 1994 are from fish slips. 1995 to 2000 data are from harvest logs.

[d] may include trawl vessels, numbers not verified

[e] revised in 2000

Note: Actual landed value is likely higher due to payment of bonuses after the season ends. These numbers do not get accounted for in the slip system.

Table 4.3.3. Summary of prawn trap landings in tonnes, by month and area in 2000, as reported on harvest logs.

	Total Coast	North Coast	South Coast	ECVI	WCVI	NORTH COAST MANAGEMENT AREAS														
						1	2	3	4	5	6	7	8	9	10	101	105	106	107	110
Jan																				
Feb																				
Mar																				
Apr																				
May	823	263	559	520	39		59.1	23.2	22.7	23.9	35.2	40.1	18.1	24.0	16.4		*	*	*	
June	605	157	448	404	44		11.4	19.2	16.2	3.7	27.4	37.8	8.6	10.5	14.6		*	*	4.9	
July	321	20	300	283	18		*	*		1.1	2.0	7.8	1.6	2.1	*	*	*	*	2.2	*
Aug																				
Sept																				
Oct																				
Nov																				
Dec																				
Totals	1,748	440	1,308	1,207	101		*	*	39	29	65	86	28	37	32	*	*	2	*	*

	SOUTH COAST MANAGEMENT AREAS																	
	ECVI, East Coast Vancouver Island & Fraser/Howe Sound											WCVI, West Coast Vancouver Island						
	11	12	13	14	15	16	17	18	19	28	29	23	24	25	26	27	111	123	124
Jan																			
Feb																			
Mar																			
Apr																			
May	6.9	206.6	52.7	24.5	80.7	70.5	58.4	5.1	11.1	1.2	2.6	12.6		17.7	*	*			
June	7.1	99.9	28.6	43.3	53.7	33.6	45.5	22.1	15.8	35.0	19.2	20.5	*	14.9	*	*			
July	8.2	47.6	12.9	42.0	23.8	34.7	31.8	22.4	23.3	16.9	19.0	7.5	*	4.0		2.8	*	*	*
Aug																			
Sept																			
Oct																			
Nov																			
Dec																			
Totals	22	354	94	110	158	139	136	50	50	53	41	41	*	37	*	13	*	*	*

* Data obscured due to confidentiality requirements i.e. Less than 3 vesseel fishing.

Table 4.3.4. Summary of prawn trap landings (tonnes) by year and area, as reported on fish slips (1980 to 1994) and harvest logs (1995 to 2000).

	TOTALS					NORTH COAST MANAGEMENT AREAS																
Year	Total Coast	North Coast	South Coast	ECVI	WCVI	1	2	3	4	5	6	7	8	9	10	101	102	105	106	107	108	110
1980	361	102	259	221	39	<	1	4	6	2	29	19	24	13	4							
1981	320	116	204	151	53		3	4	<	2	51	27	23	1	4							
1982	264	70	194	113	81		2	2		1	30	15	12	4	3							
1983	325	116	208	186	23	<	1	10	3	8	27	35	18	7	5							
1984	377	89	288	249	39		<	2	3	7	37	17	14	2	6							
1985	509	98	411	384	27	<	1	14	1	6	15	25	25	6	4							
1986	543	128	415	390	25	<	4	25	4	5	25	22	21	13	7							
1987	616	159	455	399	56	2	1	13	8	2	21	42	40	21	10							
1988	714	233	481	411	70	1	4	12	21	1	40	82	38	18	17							
1989	805	216	589	479	110	4	1	8	12	2	49	69	31	15	25							
1990	757	126	631	556	75		5	2	8	1	20	39	19	17	16							
1991	954	188	767	673	94	2		6	17	5	26	47	29	31	25							
1992	1,166	273	890	778	112	8	8	21	6	17	46	75	32	44	16							
1993	1,211	312	899	787	112	<	2	11	<	36	52	109	43	40	20							
1994	1,307	428	879	755	125			7	23	39	85	135	67	46	26							
1995	1,329	429	900	774	127		•	39	60	52	87	87	44	41	13				•	•		
1996	1,715	627	1,088	985	103		39	29	8	107	140	173	53	54	16		•			•		
1997	1,785	364	1,422	1,312	109		31	30	20	23	68	53	55	40	35				3	•		
1998	1,734	359	1,375	1,272	103		68	12	3	41	49	86	36	45	4			•	•	13	•	•
1999	1,462	395	1,068	994	73		77	36	20	30	61	74	33	30	16				•	6		•
2000	1,748	440	1,308	1,207	101		•	•	39	29	65	86	26	37	32	•		•	2	•		•

	SOUTH COAST MANAGEMENT AREAS																					
	East Coast Vancouver Island											West Coast Vancouver Island										
Year	11	12	13	14	15	16	17	18	19	28	29	20	21	23	24	25	26	27	111	123	124	127
1980	2	49	24	12	8	47	32	13	7	25	2	<	<	16	1	14	<	7				
1981	1	39	10	8	7	44	9	9	2	17	4			15	2	29	3	4				
1982	3	33	8	3	3	22	11	5	<	20	5	1		13	1	59	<	7				
1983	7	75	9	13	15	21	9	4	1	26	8	<		9		11	1	2				
1984	9	63	23	12	20	52	21	14	1	22	12	1	1	21	5	8	2	1				
1985	2	157	30	17	39	60	29	5	<	31	15	<		17		6	1	2				
1986	1	158	31	8	54	63	27	2	12	24	9		<	20	1	3	<	2				
1987	16	80	40	10	74	99	21	3	11	36	11	10		23	8	12	2	1				
1988	8	130	33	21	89	63	16	5	8	23	15	9		19	1	22	17	2				
1989	8	112	49	32	88	117	36	7	3	14	14	2		15	1	35	42	16				
1990	4	231	54	28	93	78	33	6	5	12	14			13	4	20	21	17				
1991	12	255	64	38	99	138	33	6	4	22	2			25	1	21	11	38				
1992	7	277	71	59	150	126	44	7	15	14	9		<	28	<	22	31	32				
1993	14	188	99	62	142	169	37	10	11	13	23	<		32	1	24	25	29				
1994	18	159	98	49	165	156	49	22	9	8	21		<	42	4	45	19	15				
1995	12	180	123	77	141	83	54	11	16	57	20			64	2	40	10	12				
1996	14	375	101	77	152	110	90	8	17	21	21	•		49	•	31	8	13				
1997	25	473	109	100	193	198	138	11	18	32	16			51	•	37	11	8	•			•
1998	28	311	137	122	267	196	136	9	13	30	23			45	2	35	•	14	•	•		•
1999	22	366	148	70	150	102	84	12	12	11	13			29	1	32	•	•				
2000	22	354	94	110	158	139	136	50	50	53	41			41	•	37	•	13	•	•	•	

Landings for 1980 to 1994 reported from fish slips. 1995 to 1999 landings reported from harvest logs. The fish slip database does not differentiate landings from offshore areas.

< = catch reported is less than 500 kg.

• - less than three vessels reported landings.

Table 4.3.5. Record of Management Strategies

1979	Spawner index management commences.
1983	Spawner index compared to 80% upper confidence interval of sample means; strings pooled, boats averaged equally; separate Z licence established; harvest log requirement established.
1984	Males often but not always included in spawner index calculations; 80% C.I. used
1985	Males not often included in spawner index calculations; 30 mm. carapace length minimum size limit in regulation but not implemented; 6 study areas identified; Work Channel, Gardner Canal, Rivers Inlet, Sechelt Inlet, Alberni Canal, Howe Sound.
1988	75% C.I. of index used, no males; trap escapement modifications (minimum mesh size) implemented; 30 mm. minimum size limit put into effect; Saanich Inlet managed as a special management area (delayed openings).
1989	Trap types standardized by catch efficiency, for calculation of spawner index; 75% C.I. used; Prawn Sectoral Committee established; Queen Charlottes Area 2E and 2W managed separately from mainland north coast fishery.
1990	Spawner index data collected by trap instead of by string; licence limitation implemented, 1000 lbs. landed in any two years of 1986 - 1988; 125 licences qualify in initial round, this increases to 259 licences following appeals; standardized marking of gear required; portion of Howe Sound and Muchalat Inlet closed due to dioxin contamination.
1991	Trap quantity limitation discussions commence.
1992	W licence replaces Z-H licence; hail requirements established every 4 weeks; 6 study areas removed from "study area" status but still managed as discrete fisheries; only Howe Sound continues as a research area.
1993	Daylight fishing only, .5 hr. before dawn to .5 hr. after sunset.
1994	Max. trap size 140 L; hail required every 2 weeks; industry balloted for trap limitation and program funding, trap limitation passes.
1995	Trap limitation initiated for 2 year pilot program; 300 traps or 450 for 2 (max.) stacked licences; max trap volume 170 L; spawner index closures enacted when 75% C.I. achieved; no males included in spawner index; hail every 4 weeks; TB submission, licence fee is $200, management fee is $1135; Muchalat Inlet added to special management areas; remainder of Howe Sd. added to existing special management areas (dioxin closures rescinded); PSC election of industry representatives.
1996	Spawner index sample mean used as closure trigger; 258 eligible licences; 253 licences issued; licence fee raised to $320, no change in mgmt. fee; 32 mm. size limit adopted; Howe Sd. opened April 15 for 10 days; all SMA's opened Sept. 9 for 7 to 14 days however this was after the closure of the regular fishing season which caused considerable numbers of vessels to participate in the SMA opening – late opening is considered unsatisfactory for management.
1997	257 licences; trap limitation pilot extended 1 year; logbook format changed following consultation with industry;33 mm. size limit adopted; Muchalat Inlet removed from SMA status; QCI opens April 15 for 30 days; all SMA's open May 1 for 1 to 2 months; berried female release required until June 30; % medium catch levels considered in closure decisions; Saanich Inlet fished to 25% higher spawner index to maintain recreational fishing opportunity following the commercial fishery; PSC election fall 1997.
1998	Trap limit program continues. Future Management Options and other caucus subcommittees established; Treasury Board submission established for 1998 to 2001, licence fee is $320; management fee is $1470; double bucket traps prohibited by specifying a maximum trap volume by trap type; mesh measuring tool "slat" described; All special management areas open April 23rd

Table 4.3.5. continued

1999	with the remainder of the coast, SMAs have 50% trap limits and close on spawner index; QCI monitored for spawner index for first time.
2000	Important recreational harvest areas left at higher index; Saanich continues at 25% higher; Howe Sound weak at opening; closed and re-opens later in season; PSC election.
2001	One year pilot program implemented by DFO; daily single haul limit in southern waters, limited hours in single haul area (7 a.m. to 7 p.m.), area licensing (2 areas), 500 traps for stacked licences; Saanich Inlet and important recreational areas fished to index +25%; all other coastal areas fished to index +10%; shallower double ring trap enters fishery; efficiency unknown; coast wide opening delayed until May 5 due to late sign off and Licensing workload/scheduling requirements; General industry meeting, Sept.; industry invited to draft future commercial harvest plans, subject to principles of conservation, Section 35 obligations, enforceability, cost neutrality, licence holder buy, consultation requirements.
2002	Reg. change to eliminate management fee, licence (access) fee continues at $320; Treasury Board agreement expires March 31, 2001; industry representatives choose management features and draft commercial harvest plan.

Table 4.3.6. Record of Openings and Closures, 1979 to present.

1979 – 1984		fishing open throughout the year.
1985	South coast	**first south coast annual closure**, Jan.4.85 to Mar.31.85; re-opens Apr.01.85
	Saanich Inlet	Area 19 did not open this year
	Howe Sound	Area 28 opening delayed to May 1
	North coast	open throughout the year
1986	South coast	re-opens Apr.01.86
	Saanich Inlet	opening delayed to June 1
	Howe Sound	Areas 28 and 29 open May 1
	North coast	open throughout the year
1987	South coast	annual closure Jan.10.87 to Mar.31.87; South coast re-opens Apr.01.87
	North coast	open throughout the year
1988	South coast	annual closure Jan.01.88 to Mar.31.88; South coast re-opens Apr.01.88
	Saanich Inlet	opening delayed to Sept.
	North coast	open throughout the year
1989	South coast	annual closure Jan.01 to Mar.31.89, open Apr.01.89 to Dec.31.89
	Saanich Inlet	opening delayed to Sept.
	North coast	**first north coast annual closure**, Dec.31.88 to Mar.31.89, open Apr.01.89 to Dec.14.89
	Queen Charlottes	opens for Sept. only
1990	Coast wide Closure	Jan.01 to Mar.31.90; coast re-opens Apr.01
	Salmon/Sechelt Inlet	opening delayed to Sept.3 with 200 trap limit
	Queen Charlottes	opens for Sept. only
	Dioxin and furan	closures introduced in Howe Sound, Pr. Rupert and Muchalat Inlet in Nov.
1991	Coast wide	closure Jan.01 to Mar.31.91; coast re-opens Apr.01
	Queen Charlottes	open Sept. only
1992	Coast wide closure	Jan.01 to Mar.31.92; coast re-opens Apr.01
	Howe Sound	opens Jul.8 with 250 traps, 50 traps/line, 5 groundlines (250/50/5)
	Salmon Sechelt	opens with trap limits
	Saanich	opens with trap/groundline limits 200/50
	Queen Charlottes	opens April only
1993	Coast wide closure	Jan.01 to Mar.31; coast re-opens Apr.01

Table 4.3.6. continued

	Alberni	opens with 240/40 trap limits	
	Howe Sound	opens with 250/50 trap limits	
	Saanich Inlet	opens Sept. 13 with 200/50 trap limits	
	Salmon/Sechelt	opens with 250/50 trap limits	
	Queen Charlottes	opens April only	
1994	Coast wide closure	Jan.01 to Mar.31.; coast re-opens Apr.01	
	South coast	closed Nov.18	
	Alberni	opens Jun.27 with 240/40/6 trap limits	
	Howe Sound	opens Apr.1 with 250/50/5 trap limits	
	Saanich Inlet	opens Sept.12 with 200/50/4 trap limits	
	Salmon/Sechelt	opens Apr.1 with 250/50/5 trap limits	
	North coast	closed Nov. 24	
1995	Coast wide	closure Jan.01 to Apr.18; re-opens Apr.19; season opening delayed due to trap limitation implementation	
	Coast wide	closed Oct.30	
	Dioxin and furan	closures rescinded; Muchalat Inlet becomes special management area	
	Howe Sound	dioxin area added to Howe Sd. special management area	
	Alberni Inlet	opens Jun.30 with 150/3 or 225/4 trap/groundline limits; closed Aug.28	
	Muchalat In.	opens Jun.30 with 150/3 or 225/4 trap groundline limits; closed Sep.18	
	Howe Sd./Indian A.	opens Sep.18 with 150/3 or 225/4 trap groundline limits; closed Oct.03	
	Saanich Inlet	opens Sep.18 with 150/3 or 225/4 trap groundline limits; closed Oct.13	
	Salmon/Sechelt	opens Sep.18 with 150/3 or 225/4 trap groundline limits; closed Oct.18	
	Queen Charlottes	opens Apr. 19; closed May 31	
1996	Coast wide closure	Jan.01 to Apr.14; re-opens Apr.15; season opening delayed to protect ovigerous females	
	Coast wide	closed Aug.15	
	Howe Sd./Indian A.	opens Apr.15, 150/3 or 225/4; Howe Sd. closed Apr.25; reopens Sep.09, closed Sep.16	
	Alberni Inlet	opens Sep.09 with 150/3 or 225/4 trap/groundline limits	closed Sep.23
	Muchalat Inlet	opens Sep.09 with 150/3 or 225/4 trap/groundline limits	closed Sep.23
	Saanich Inlet	opens Sep.09 with 150/3 or 225/4 trap/groundline limits	closed Sep.23
	Salmon/Sechelt	opens Sep.09 with 150/3 or 225/4 trap/groundline limits	closed Sep.20
	Queen Charlottes	opens Apr. 15; closed Aug. 15	
1997	Coast wide	closure Jan.01 to Apr.14; reopens Apr.15; non-retention of ovigerous females until June 30	
	North coast	closed Jul. 16	
	Queen Charlottes	opens Apr.15, full trap allocations, closed May 15	
	South coast	closed Jul.29	
	Howe Sd./Indian Arm	opens May 1 with 150/3 or 225/5 trap/groundline limits	closed Jun.5 & Jul.2

Table 4.3.6. continued

	Alberni Inlet	opens May 1 with 150/3 or 225/5 trap/groundline limits	closed Jul.17
	Muchalat Inlet	removed from special management area status	
	Saanich Inlet	opens May 1 with 150/3 or 225/5 trap/groundline limits	closed Jun.24
	Salmon/Sechelt	opens May 1 with 150/3 or 225/5 trap/groundline limits	closed Jul.29
1998	Coast wide closure	Jan.01 to Apr.22; re-opens Apr.23 including special management areas; non retention of females	
	Coast wide	closed Jul.24	
	Howe Sd./Indian A.	opens May 1 with 150/3 or 225/5 trap 6/9 groundline limits	closed Jul. 15
	Alberni Inlet	opens May 1 with 150/3 or 225/5 trap 6/9/ groundline limits	closed Jul. 17
	Saanich Inlet	opens May 1 with 150/3 or 225/5 trap 6/9/ groundline limits	closed Jul. 17
	Salmon/Sechelt	opens May 1 with 150/3 or 225/5 trap 6/9 /groundline limits	closed July 17
	Queen Charlottes	opens Apr.15, closed Jun. 1	
1999	Coast wide closure	Jan. 01 to Apr. 21; re-opens Apr. 22 including special management areas	
	Coast wide	closed Jul. 9, 79 days	
	Howe Sd./Indian A.	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed Jul. 15
	Alberni Inlet	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed Jul. 17
	Saanich Inlet	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed Jul. 17
	Salmon/Sechelt	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed July 17
	Queen Charlottes	opens Apr.22, closed Jun. 1	
2000	Coast wide closure	Jan. 01 to May 4; re-opens May 5 including special management areas	
	Coast wide	closed Jul. 28, 85 days	
	Howe Sd./Indian A.	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed July 21
	Alberni Inlet	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed July 14
	Saanich Inlet	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed July 24
	Salmon/Sechelt	opens Apr. 22 with 150/3 or 225/5 trap 6/10 groundline limits	closed July 28
	Queen Charlottes	opens Apr.22, closed Jun. 1	

Table 4.3.7. 21 year summary of spawner index sampling by area.

AREA	2000	1999	1998	1997	1996	1995	1994	1993	1992	1991	1990	1989	1988	1987	1986	1985	1984	1983	1982	1981	1980
2	661	959	654		371																
3	610	508	145	510	80	71							124		69	31	23	30			
4	233	131	128	207		42									38	16					
5	361	612	758	302	771	50															
6	880	778	1027	991	1429	535										44		64			
7	709	838	1222	476	1395 [1]	532		175	150	129	167						62			171	116
8	394	327	432	673	950 [2]	64			75			226									267
9	271	549	464	445	160 [3]	374			90												
10	251	220	142	605	247	180															
11	300	300	175	490		143															
12	2806	2397	2607	1837	1854	2321 [4]	435	482	749	867	1033	486	677	821	1625	898	366	553	264	453	665
13	1886	1406	1540	1309	1351	586	374			276	124	366	333		173	343	267			30	285
14	1842	1788	1054	886	506	493	736	427		380	695	419	42	56	35	302	42		100		
15	1497	2512	2046	1427	578	1390	753	370	220	523	177	956	822		123	1022					
16	1412	2672	1592	1111	1630	1568	1321	621	721	1484	783	1246	1837	673	473	601	1457	414	526	1884	728
17	1026	895	444	955	662	1076	292	194	291	873	342	66	81	114	290	741	326	45	602	497	335
18	44	77																-	148	955	521
19	874	150	215	222	290	653	186	241	315	273	1240	173	116	440	343		284	288			
23	1566	961	1269	1016	932	997	359	169	442	14				103	259	763	811	565	1408	683	708
25	1631	1625	1242	1164	1107	1186						297	300	116	189	757	659	782	1557	921	1522
26	263	162	454	213	241	229					221										
27	294	150	150	125		323	136				52					139			288	-	
28	1789	1039	2186	1505	1261	546												365	558	648	
29	133	140	145	516	126	76											180				
107			141																		
Total	21733	21196	20232	16985	15941	13435	4592	2679	3053	4799	4834	4237	4332	2323	3617	5657	4477	3076	5451	6242	5147

[1] 480 traps in Area 7 were sampled as part of a Science research survey

[2] 240 traps in Area 8 were sampled as part of a Science research survey

[3] 60 traps in Area 9 were sampled as part of a Science research survey

[4] 760 traps in Area 12 were sampled as part of a Science research survey

Table 4.3.8. Monthly spawner index

	Original Baseline Spawner Index	2000/ 2001 Coastal Target Index	Recr.& Spec. Mgmt. Areas Index	SEX CLASS INCLUDED IN INDEX CALCULATION
APR.	6.4	7.0	8.1	all 2's and 3's[a]
MAY	5.9	6.5	7.4	all 2's and 3's[a]
JUN.	5.4	5.9	6.8	all 2's and 3's[a]
JUL.	4.9	5.4	6.1	all 2's and 3's[a]
AUG.	4.4	4.8	5.5	all 2's and 3's
SEP.	4.1	4.5	5.1	all 2's, 3's, and 4's
OCT.	3.6	4.0	4.5	all 3's and 4's; (class 2s have grown to class 3s)
NOV.	3.2	3.5	4.0	all 3's and 4's
DEC.	2.7	3.0	3.4	all 4's; (class 3s have all become berried up)
JAN.	2.4	2.6	3.0	all 4's and 5's
FEB.	2.0	2.2	2.5	all 4's and 5's
MAR.	1.7	1.9	2.1	all 4's and 5's
		1's		mature males
		2's		transitions
		3's		females, no eggs
		4's		females with eggs (berried)
		5's		spent females

The spawner index declines monthly as a result of natural mortality.

4.4. Euphausiid Fishery – B.T. Koke

4.4.1. Introduction

The euphausiid fishery update provides an overview of the euphausiid fishery with respect to the commercial fishery on the coast of British Columbia. The catch information is inclusive of 2000.

4.4.2. Biological synopsis

Euphausiids are in the family of marine crustaceans found throughout the oceans of the world. There are 85 species of krill ranging in size from several millimetres, to the largest deep sea species reaching 15 cm in length (Baker *et al.* 1990). There are several species of euphausiids found in British Columbia waters, the dominant species is *Euphausia pacifica.*

Euphausia pacifica is a widely distributed species in the North Pacific Ocean found from Japan to southern California. It has only been fished commercially in areas in the west of its range, off Japan, and the east of its range off British Columbia (Nicol and Endo 1997). A number of comprehensive studies have been carried out into the biology and life history of the species of krill harvested in British Columbia. Much of this research has been focused on *E. pacifica* since it constitutes the predominant species harvested off Japan and British Columbia.

In British Columbia, euphausiids release their eggs directly into the water where they develop independently. The main spawning season occurs in May to July, however a second period of less intensive spawning occurs in late August through September in the Strait of Georgia (Heath 1977). The life span is estimated to be 19-22 months with growth cessation occurring in early autumn to winter, when water temperatures and phytoplankton abundance is low. Euphausiids in British Columbia are gregarious and are found in pelagic swarms or schools. This swarming behaviour makes them attractive and susceptible to directed commercial fisheries.

4.4.3. Overview of the fishery

Euphausiid species are fished under authority of a limited category "Z-F" licence. These animals are harvested commercially by fine meshed Plankton trawl nets. About twenty species of euphausiids occur in B.C. waters, but the biomass is dominated by five: *Euphausia pacifica*, *Thysanoessa spinifera*, *T. inspinata*, *T. longipes* and *T. rashii. E. pacifica* is typically one of the dominants and accounts for 70 - 100% of the euphausiid biomass in the Strait of Georgia where the commercial fishery occurs (Jamieson *et al.* 1990).

A trawl fishery began in the Strait of Georgia in 1970 as an experimental fishery and was licensed under category "Z-F" in 1983. The number of licences issued increased annually from 7 in 1983 to 56 in 1990 then declined to 45 in 1991 (Table 4.4.1). This licence became limited in 1993 for which 19 fishermen qualified after appeals. The total annual catch is 500 t divided amongst several Inlet areas and the Strait of Georgia. The commercial fishery is currently managed through limited entry licensing, conservative harvest quotas, and a hail in and dockside validation program.

Two types of vessels participate in this fishery; freezer vessels whose daily catches are generally limited due to freezing capacity; and, fresh vessels which tend to land large quantities of euphausiids for onshore processing and freezing. Catch must be frozen as soon as possible after landing, generally within 7 to 12 hours to avoid a significant deterioration of product and corresponding reduction in quality and value.

Most of the euphausiids commercially harvested in British Columbia, are frozen for use in the manufacture of fish food. A small portion of the catch is freeze dried and used as aquarium pet food. There are also new and developing markets for krill as human food products, food additives, biochemicals, enzymes, and protein concentrates (Nicol and Endo 1997).

4.4.3.1. Participants

A personal "Z-F" licence is required to participate in the commercial euphausiid fishery. The number of eligible "Z-F" licences was limited to 19 licences in 1993.

There are no known directed First Nation's fisheries for euphausiids for food, social and ceremonial purposes. There is a single commercial euphausiid licence available to First Nation's groups through the Aboriginal Fisheries Strategy (AFS) at this time. For further information on the Aboriginal Fisheries Strategy Licence Retirement/Allocation Transfer Program, see the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/afs/retire.htm.

A B.C. Tidal Waters Sport Fishing Licence is required for recreational harvest of all invertebrate species. There is no known sports fishery for Euphausiid species.

There are a limited and variable number of buyers and registered processors involved in the B.C. commercial euphausiid industry. These facilities are located in the greater Vancouver area and in French Creek in some years.

4.4.3.2. Location of the fishery

The commercial euphausiid fishery currently occurs in the following south coast inside areas: Knight Inlet (Subareas 12-28 to 12-34), Bute Inlet (Subareas 13-20 to 13-22), Homfray-Price-Lewis Channels (Subarea 15-5), Jervis Inlet (Subareas 16-11 to 16-15), and the Strait of Georgia (Subareas 15-1 to 15-3, 16-18 and a portion of 16-11). There are specific annual quotas available in each area (see Section 4.4.3.6.).

Aboriginal Communal Licences do not specify the locations permitted for use by Coastal First Nations for food, social and ceremonial harvests of euphausiids as there is no known harvest.

Recreational harvest of euphausiids is also unknown in this region at this time.

There are no specific experimental fisheries or permanent area closures within the Euphausiid Management Quota Areas as described in the 2000/2001 Multi-year Management Plan.

4.4.3.3. Time frame of the fishery

The fishery is divided into three time periods. The early season fishery in the inlet areas opens early in the New Year and continues until either the individual Inlet quota is attained or until March 31. In 2000, only Jervis Inlet (16A) and Homfray-Price-Lewis Channels (15A) closed earlier than March 31, on January 10 and 13 respectively.

There is a second opportunity to access any remaining quotas from the Inlet areas. This mid season fishery is opened upon request of fishers during the period from August 16 to October 31. There was no request to open the Inlet areas in the summer or early fall of 2000. The late season fishery in the Strait of Georgia commences in early November and continues until December 31 each year or until the quota is achieved. In the 2000, the quota for the Strait of Georgia was achieved by November 17 and the fishery was closed for the 2000 year season.

Opportunities for First Nations' and recreational fisheries are available year-round in all areas.

4.4.3.4. Landings, value and markets

Annual landings of euphausiids according to sales slip data increased from 94 t in 1984 to 530 t in 1990 (Table 4.4.1). Total catch then declined to below 60 t in 1993 and then increased to a record high of 562 t in 1995. Sales slip data for 2000 indicate 370 t, however validated landing records reflect that a total of 504 t of product were actually harvested, weighed, and confirmed landed in the fishery.

The increase in landings in 2000 from 1999 likely reflects both stronger markets as well as increased abundance of euphausiid stocks. Stock strength in Jervis Inlet again appeared to be healthy in January where 8 vessels landed slightly in excess of the target quota of 85 t in two nights of fishing again, as in 1999. The Fall opening in the Malaspina Strait commenced November 01 with landings recorded early in the opening. Both the fresh and frozen fleets were active early in the opening. The quota was achieved and the closure implemented on November 17th.

The maximum number of vessels reporting landings in any given year was 17 in 1990 since limited entry was established in the fishery. This declined to less than three vessels in 1993 but has increased in recent years: 10 vessels in 1998, 13 vessels in 1999, and 11 vessels in 2000 (Table 4.4.1).

Table 4.4.1 also describes catch effort and value for the period 1983 through 2000 as reported on harvest logs, sales slips, and commencing in 1997 with validated landings. Since 1997, the fishery has been managed in season by validated landings. However data inconsistencies continue in sales slip, logbook, and validated values in spite of combining the logbook/validation log into a single document. The greatest discrepancies occur in sales slip and harvest log/validated landings (Table 4.4.1). This is a result of two separate issues:

1. Product is often marketed well after the season closes and sometimes even in the following calendar year. As a result, the difference in sales slip and validated landings data is not expected to be resolved.
2. Differences in Harvest log data and validated landings likely results from incomplete submission of logs from fishers.

Combining the logbook and validation log in a single document did improve data quality however additional improvements will continue to be pursued. Again sales slip information may be difficult to correlate more closely due to the way the product is marketed.

From 1983 to 1987 effort (hours trawling) reported on harvest logs was relatively constant and varied between 333 and 563 hours annually (Table 4.4.1). Between 1988 and 2000 effort varied considerably, from 435 hours to 1321 hours (with the exception in 1993) in that time. In the 2000 fishery the effort totalled 435 hours, a significant decrease in effort from the 777 hours reported in 1999, even though more product was harvested in 2000. This may be linked to increased abundance, and improved efficiency and knowledge of the fishers.

Catch per unit effort ($kg \cdot hr^{-1}$) reported on harvest logs has varied from 182 to 1159 $kg \cdot hr^{-1}$ from 1984 to 2000 (Table 4.4.1). During the year of highest effort (1990) CPUE was 378 $kg \cdot hr^{-1}$. The highest catch rate of 1159 $kg \cdot hr^{-1}$ was recorded in the 2000 year fishery, a significant increase over the 526 $kg \cdot hr^{-1}$ observed in 1999. Variations in CPUE may result from number and combination of factors - i.e. changes in stock abundance, sea surface temperatures, stock distribution, and/or more aggressive and competitive fishing efforts resulting from improved markets for the product.

For all but one year up to 1989, the majority of the catch was taken from Jervis Inlet in Area 16. In 1990, as a result of the mainland inlet quotas and closer monitoring of the fishery, the fishery moved into inlets in Areas 12 and 13 where significant landings were made. In 1994, quotas were reached in Jervis and Toba Inlets and closures were implemented prior to the end of the early fishing period for the balance of the year. In 1995 according to hail data only, the quota was achieved in Bute Inlet, which closed in February. Significant quota overages occurred in Toba and Bute Inlets in 1996 as a result of a problematic catch reporting system. Improvements to catch reporting and catch validation were implemented in 1997 to provide for timely and accurate quota tracking. This management strategy has been continued since then. In 2000 the only Inlet quota targets achieved were in Jervis Inlet and Homfrey-Price-Lewis Channels, and closures were implemented Jan 10th and 13th respectively. The fall opening resulted in a closure November 17th when the total available quota was achieved.

Prior to 1990, the total annual quota had never been reached. Annual landings of euphausiids increased from 47 tonnes in 1983 to 530 tonnes in 1990. Since 1990, landings have been variable and generally between 300 and 500 tonnes. In 1993 less than 60 tonnes of euphausiids were landed due to market limitations that year. Preliminary data for 1995 and 1996 suggests that the quota was exceeded, with fish slip records of 562 tonnes, and 507 tonnes respectively. Hail records, logbooks and fish slip records are contradictory and the in-season hail reporting was inadequate. These discrepancies led to significant industry funded management changes in the 1997.

Most of the euphausiids commercially harvested currently are frozen for use in the manufacture of fish food. A small portion of the catch is freeze dried and used as aquarium pet food. The whole landed value of euphausiids varied between $.23 and $1.26 kg^{-1} between 1984 and 1996. The price varied between $.88 and $2.16 kg^{-1} in 2000. The total landed value of the euphausiid fishery is comparatively small varying between $38,000 in 1984 and $493,000 in 1998 (Table 4.4.1.) The landed value according to sales slip data and extrapolated using the validated landings in 2000 was approximately $482,000. This value is expected to be conservative and lower than the actual landed value for 2000 as a result of how the product is marketed.

The euphausiid fishery has been market limited but interest is increasing and many new types of markets are emerging. Human food products, biochemicals, pharmaceuticals, and as human food additives are some of the forms of potential direction for market expansions. Fishers advise that the current market limitations result from the low amount of quota available to the fishery. Development of better markets relies upon higher volumes and the ability of fishers to guarantee delivery of product. The current open competitive fishery and low quota targets make the contractual agreements sought in the market place difficult to accommodate.

Alternate value added products are being examined by industry to enhance the potential of the fishery. This is supported both by DFO and the Krill Trawlers Association through assigning the option for 10 tonnes of the total annual quota to be available for the development of: new fishing techniques; to promote improved quality to landed products; and, to explore development of new products. Interest remains high in pursuing new approaches to improving product value particularly in light of the limitations in quota and the policy to continue to maintain the 500 t TAC. Regulatory amendments may be requested from some fishers to allow for relaxation of the processing at sea P licence requirements to allow freezing at seas by non catcher vessels.

4.4.3.5. Consultative Process

A more structured consultative process was initiated for the Euphausiid fishery after limited entry in 1993. It is an important part of the planning process for the commercial fishery. The primary consultative body for euphausiids in British Columbia is the Euphausiid Sectoral Committee. This committee includes representatives from Fisheries and Oceans Canada, commercial licence holders, and processors. First Nations groups, B.C. Ministry of Fisheries and the Sport Fishing Advisory Board are also welcome to participate in the process. Members of the Krill Trawlers Association represent commercial fishers on this committee. Past participation by First Nation groups and the B.C Ministry of Fisheries has been limited.

The Committee's primary mandate is to provide the Department advice with respect to issues important to the management of the commercial euphausiid fishery, including developing harvest plans, scheduling research activities, and investigating new management strategies. The Committee is not a voting body but allows for the Department to receive a broad range of advice from First Nations, stakeholders and other concerned parties on matters relating to the management of the fishery. The Department retains the decision-making authority regarding management of the fishery. The Sectoral Committee meets as required to review and provide advice regarding the proposed management plan. Meeting opportunities usually occur annually. However with the introduction of multi-year fishing plans in 1998, annual meetings are not always necessary, but may be called at the request of fishers.

Coastal First Nations are notified of the Sectoral and Research meetings by letter and Fishery Notices.

The primary consultative body for the recreational fishing community is the Sport Fishing Advisory Board (SFAB). The SFAB has representatives from all parts of the recreational fishing community (examples are the B.C. Wildlife Federation and the Sport Fishing Institute of B.C.).

Following input from the Sectoral Committee, the draft management plan is distributed to First Nations and other stakeholders (i.e. commercial industry representatives) for review and comment at least 30 days prior to the Department's internal finalization process. Stakeholder input to the draft management plan is finalized prior to November 01.

The final management plan, which incorporates advice received from stakeholders, is approved in the Pacific Region and published four weeks prior to the fishery opening. The management plan is made available to the public through the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/mplans/mplans.htm and in hard copy at Department area offices.

4.4.3.6. Management styles

Commercial fishery – recent

An adaptive management plan was developed and implemented for the commercial euphausiid fishery since limited entry in 1993.

Currently, the main management tools of the commercial euphausiid fishery include: limited entry licensing; periodic openings; area quotas; and an industry funded hail in and dockside validation program.

Limited licence entry

A limited entry licensing scheme was implemented in 1993 when 19 licences were issued after appeals. The actual level of participation has varied since this time however in most years is well below the maximum number (Table 4.4.1).

Precautionary fixed exploitation rate

Under the precautionary management plan, an arbitrary coastwide quota of 500 tonnes was established. As a matter of policy, Fisheries and Oceans Pacific Region is not prepared to authorise increases in the euphausiid quota, as euphausiid are a forage species upon which many other species depend. As such, the existing fishery quota in the Strait of Georgia will be maintained at 500 tonnes provided that management controls are sufficient to adequately track quotas and collect accurate catch and effort data. No increase in quota will be considered until such time as a sound scientific basis is provided and accepted by the DFO Regional Management Executive Committee (RMEC).

Surveys and studies are undertaken in most years in the Strait of Georgia, sometimes twice a year. The harvest area commercial TACs, whether calculated from original surveys or arbitrary precautionary quotas, are considered conservative and sustainable.

Total Allowable Catch and area quotas

No increase in quota will be considered until such time as a sound scientific basis is provided and accepted by the DFO RMEC. The following Euphausiid Management Quota Area descriptions are based on the *Pacific Fishery Management Area Regulations* (see Section 4.4.7.5).

Hail in and Dockside Validation program

Before 1997, quotas were managed through weekly hails of catch to fishery managers, as a condition of licence. Compliance with this requirement was variable, in some cases adversely affected by poor communication links to remote coastal inlets. Quotas in some areas were exceeded on occasion. Changes to the management plan were introduced in 1997 as a result of these deficiencies. An industry funded hail in of fishing activity and dockside landing validation program was initiated in 1997 to address inadequate hailing of fishing activity practices, quota overages, and data inconsistencies. Fishers are require to advise a service bureau of when their fishing activities begin and terminate, and to have all product weighed and validated as it is landed at designated locations. This is the fourth year of the program. It has been successful in preventing quota overages, and in improving data inconsistencies.

In 2000, the "hail in and dockside" validation program was effective in preventing significant quota overages. Again, the validation staff inspected the product landing for presence of by-catch. Limited and minimal by-catch (small herring) was observed in the January fishery however despite heavy fishing efforts in the Fall fishery no by-catch was observed. As a result of the continued improvements in quota tracking, and overall management of the fishery including product inspections for the presence of by-catch, the "hail in and validation" management program is to be continued in 2001 and future years.

Area Descriptions and Quotas

Euphausiid Management Quota Area	Location	Pacific Fishery Management Area and Subarea	Quota (tonnes)
12A	Knight Inlet	12-28 to 12-34 inclusive	75
13A	Bute Inlet	13-20 to 13-22 inclusive	55
13B	Loughborough Inlet	13-42 and 13-43	0
15A	Homfray-Lewis-Pryce Channels	15-5	40
15B	Toba Inlet	15-6	20
16A	Jervis Inlet	16-11 to 16-15 inclusive	85
28A	Howe Sound	28-1 to 28-5 inclusive	0
	Total – Mainland Inlets		**275**
16B	Other areas, Strait of Georgia	15-1 to 15-3 inclusive, 16-18 and portion 16-11 (See section 8.2.2)	215
16C	Scientific Licence access	16-11 to 16-15	10
	Total – Annual Quota		**500 tonnes**

Commercial Fishery:

Quotas were established in 1976 for the euphausiid fishery due to concerns of harvesting a forage species upon which salmon and other commercially important finfish depend. The annual catch was set at 500 t with an open season from November to March to minimise the incidental catch of larval and juvenile fish. The quota was estimated to be less than 3% of the annual consumption of euphausiids by all predator species in the Strait of Georgia. The opportunity to fish in Howe Sound for a 25 t quota was introduced in 1986. In 1989, the annual quota was increased to 785 t, 500 t for the Strait of Georgia and 20 to 75 t each for several major mainland inlets. In 1990, due to concerns for declining catch rates and potential local overfishing in Jervis Inlet and Howe Sound, the inlet quotas were subtracted from the Strait of Georgia quota resulting in a quota of 215 t for the Strait and a total annual quota of 500 t. Also commencing in 1990, the inlets remained open in the spring fishery until May 31.

In 1991, acting on the advice of industry, the Department of Fisheries and Oceans provided for a split season in the inlet areas for the periods of January to May and August 16 through December 31.

The Strait of Georgia fishery was limited to the period of November through December only. This was modified again in 1992, also on the advice of industry, so that the mainland inlets were open August 16 as in 1991 but to November 4 only. The Strait of Georgia opened November 4 with a quota of 215 t, as in 1991, plus the balance of the un-fished quotas from the mainland inlets. This was to ensure that industry would be able to harvest the entire 500 t quota. Previous to this, portions of quotas were left un-fished in some of the mainland inlets, as it was uneconomic to complete the quotas.

The 1993 quotas were the same as for the 1992 season with the exception of Loughborough Inlet where the quota was eliminated and transferred to the Homfray-

Price-Lewis (HPL) quota. This was done in consultation with industry as fishers indicated that there were not sufficient stocks in Loughborough Inlet to support a fishery. In 1995 at the request of industry, the Inlet areas would close for the season no later than September 30 and the Malaspina Strait Area opening was moved ahead to October 01. In addition, the Malaspina Strait area was expanded to include a portion of subarea 16-11 (lower Jervis Inlet) to provide for safer fishing operations during adverse weather conditions. This pattern was followed again in 1996. In 1997 the fishers requested alteration of the fishing plan to provide for an Inlet area opportunity until the end of October, with the Malaspina Strait fishery delayed until November 01. This opening strategy was continued in 1998, 1999, and 2000.

The winter-spring opening period for the Inlet areas was reduced by two months in 1997 to January 01 to March 31. Eliminating the fishery during the months of April and May was done to avoid potential by-catch of juvenile salmonids and other juvenile fish. Again the reduction in the time period of the fishery has the potential to reduce the resources required to monitor the fishery.

Prior to 1997 the various quotas were managed through weekly hails (telephone calls) from fishers to fishery managers to advise of their fishing area and catches, as a condition of licence. Compliance with this method of management varied, (in some cases due to poor communication links with remote areas) resulting in inadequate hailing practices, quota overages, and inconsistent hail and sales slip data. Before 1990 the total annual 500 t quota had never been reached. However in both 1995 and 1996 (Table 4.4.1) the quota was exceeded according to sales slip data, whereas hail data reflected landings below the annual 500 t quota. The inconsistency in data was considered to be unacceptable particularly in light of public sensitivity to the fishery and limited resources available within DFO to monitor the fishery. In 1997 an industry funded “hail in and dockside validation program was initiated to address these data discrepancies. This program was continued in 2000 as significant improvements in data quality and consistency were observed.

Openings and Closures

Year	Inlets, winter/spring	Inlets, summer	Strait of Georgia
1990	inlets close Mar. 31		
1991	inlets close May 31		
1992	“	Open Aug.16 – Nov.1	Open Nov.4 – Dec.31
1993	“	Open Aug.16 – Nov.1	Open Nov.1-Dec.31
1994	“	Open Aug.16 – Oct.1	Open Nov.1-Dec.31
1995	13A closed Feb 10. Remaining Inlet areas closed May 31	no request to open	Open Oct.1 - Dec.31
1996	15B closed Jan 19; 13A closed Feb 22; and 16A and 15A closed Mar 19.	No request to open	Open Oct 01 - 16.
1997	16A closed Jan 8; 15A closed Feb 19; 13A and 15B closed Feb 20.	No request to open	Open Nov 01 to Dec 31.
1998	16A closed Jan 8.	No request to open	Open Nov 01 to Nov 23
1999	16A closed Jan 6	No request to open	Open Nov 01 to Nov 23
2000	16A closed Jan 10. 15A closed Jan 13.	No request to open	Open Nov 01 to Nov 17

Aboriginal Fishery:

The First Nations' harvest of shellfish for food, social and ceremonial purposes is regulated through the *Aboriginal Communal Fishing Licences Regulations* made under the *Fisheries Act*. The communal licences issued to First Nations under the authority of these Regulations outline the harvest area, any harvest or gear limitations, as well as the harvest reporting requirements. A minimum of two percent of the coastwide TAC is generally reserved for First Nations' food, social and ceremonial needs for most shellfish species. Currently there is no directed First Nations fishery for euphausiids and therefore no TAC have been set aside.

Recreational Fishery:

There is no directed sport fishery on euphausiids, however by regulation for any species for which a specific limit is not identified the daily maximum sport limit is 20, with a possession limit of 40. This limit would apply in the event a directed sport fishery was to develop.

4.4.3.7. Links with other planning initiatives

Planning initiatives such as the Oceans Act, B.C. Ecological Reserves, Parks Canada, Selective Fishing, the Canadian Code of Conduct for Responsible Fishing Operations and Treaty Negotiations are considered in the management of this resource.

4.4.3.8. Aquaculture and Enhancement

The Department recognizes the aquaculture industry as a legitimate user of Canada's aquatic resources and will provide access to brood stock and seed stock for industry development purposes (growth and diversification), by scientific licence, on an as-needed basis, subject to conservation requirements. Any requests to access the wild euphausiid resource for development purposes must be supported by detailed project proposals, approved by the Department.

4.4.3.9. Policy

Proposed Pacific Region Interim Operating Guidelines Regarding Access to Shellfish for Aboriginal Harvesting

Fisheries and Oceans Canada is developing these guidelines in order to help the Department evaluate future requests submitted by Aboriginal people for management changes in commercial and recreational shellfish fisheries for the purposes of securing access to shellfish resources for food, social, and ceremonial purposes. These principles and proposed procedural guidelines will apply only to shellfish species in tidal waters.

Draft Pacific Region Policy on the Culture of Marine Invertebrates

A policy on the culture and enhancement of invertebrates in the Pacific Region is being developed and reviewed. Consultation will continue with the commercial industry, First Nations and other stakeholders.

4.4.4. Stock Status

The published information available on the biology and abundance of the Euphausiids in British Columbia is limited, and therefore the fishery has been designated by the Department as being "data-limited". As such, a precautionary approach to the management of this fishery has been adopted through an adaptive management plan. An arbitrary quota of 500 tonnes has been established in the fishery. Biomass surveys have been conducted twice annually in recent years. Preliminary assessments of the results of these surveys indicate that this level of harvest is very modest. The key scientific requirement in the development of precautionary management strategies for data-limited or "developing" invertebrate fisheries has been identified as information on the abundance, distribution and productivity of the species (Perry *et al.* 1999)

The Department, fishers, and the KTA continue to conduct sporadic research that will contribute towards an improved understanding of the resource, new and alternative markets, and a biologically based management plan.

4.4.4.1. Biology, Environment, Habitat and Species Interactions

Euphausiids are in the family of marine crustaceans found throughout the oceans of the world. There are 85 species of krill ranging in size from several millimetres, to the largest deep sea species reaching 15 cm in length (Baker *et al.* 1990). There are several species of euphausiids found in British Columbia waters, the dominant species is *Euphausia pacifica*.

Euphausia pacifica is a widely distributed species in the North Pacific Ocean found from Japan to southern California. It has only been fished commercially in areas in the west of its range, off Japan, and the east of its range off British Columbia (Nicol and Endo 1997). A number of comprehensive studies have been carried out into the biology and life history of the species of krill harvested in British Columbia. Much of this research has been focused on *E. pacifica* since it constitutes the predominant species harvested off Japan and British Columbia.

There are several features that distinguish the euphausiids from other crustaceans: the gills are exposed below the carapace unlike those of most other advanced crustaceans which are sheltered within it; and there are luminous organs (photophores) that produce blue light. The photophores are located at the base of the swimming legs, at the base of the genital segment of the cephalothorax, near the mouth parts and in the eyestalks. The general body plan is similar to many familiar crustaceans. The fused head and trunk, the cephalothorax, contains most of the internal organs, the digestive gland, stomach, heart, gonads, and externally the sensory appendages, the two large eyes and feeding appendages. The limbs of the cephalothorax are modified into highly specialised feeding appendages; the nine mouth parts are modified for handling and grinding food, and the six to eight pairs of food collecting limbs trap food particles from the water and move them to the mouth. The muscular abdomen has five pairs of swimming legs (pleopods) which move in a smooth paddling rhythm (Nicol and Endo 1997). Krill are heavier than water and stay afloat by swimming in bursts which are interspersed by short resting bouts (Kils 1979).

The euphausiid species commercially harvested in British Columbia have separate sexes. The females spawn their eggs directly into the water where they develop independently. The main spawning season occurs in May to July, moreover a second period of less intensive spawning occurs in late August through September in the Strait of Georgia (Heath 1977). The development includes an early planktonic phase, but as they grow and increase in size they become mobile and able to move through their environment, and to maintain themselves in particular areas in the water column. The life span is estimated to be 19-22 months with growth cessation occurring in early autumn to winter, when water temperatures and phytoplankton abundance is low. The ability to actively swim and move independently occurs in the adult form and is referred to as micro-nekton. This mobility distinguishes euphausiids from planktonic plants and animals, which drift at the mercy of tides and currents. The ability to swim allows these animals to actively move through the water, and to complete migrations up and down through the water column.

Euphausiids in British Columbia are gregarious and are found in pelagic swarms or schools. This swarming behaviour makes them attractive and susceptible to directed commercial fisheries and to predators. They are considered to be an important forage species. Recent studies have indicated that they constitute an important food source for a variety of fish stocks including Pacific hake, Pacific herring, dogfish, sablefish, (Tanasichuk 1995) as well as Pacific halibut, and Chinook and Coho salmon.

4.4.4.2. Assessment

Research has been ongoing since the beginning of the fishery in the early 1970's in British Columbia. However, very little published information is available on these endeavours.

In 1994, 1995, and 1996 acoustical mapping surveys with verification tows, were conducted by DFO Science Branch in Jervis Inlet and Malaspina Straits areas in October/November prior to fishing effort and again in January/February after fishing efforts had ceased. Also between June 1994 and the Summer of 1995 joint DFO/industry monthly surveys were conducted supported by external funding sources. The results of these surveys indicate that the present harvest levels are a small fraction of annual average standing stock. (Mackas. D 1996, personal communication).

In 1998, DFO staff from the Institute of Ocean Sciences carried out four biomass/distribution surveys in the Strait of Georgia between Tern Point in the Sidney area, and Cape Mudge near Campbell River. The surveys included assessments in the Malaspina Strait and Lower Jervis Inlet areas where the majority of commercial harvest occurs. The surveys were hydroacoustical assessments done during daylight hours in February, March, July, and October using standard gear from CCG Research Vessels. Preliminary results suggest biomass estimates 10-15% below the estimates derived from surveys conducted in 1997 (Romaine, S 2000 Pers. Comm.). These results appear to contradict the improved yields and record high CPUE's observed in the 1998 commercial fishery. There are also some recent publications from surveys on the West Coast of Vancouver Island by Tanasichuk in 1998:

Tanasichuk, R.W. 1998. Interannual variations in the population biology and productivity of *Euphausia pacifica* in Barkley Sound, Canada, with special reference to the 1992 and 1993 warm ocean years. Mar. Ecol. Prog. Ser. 173:163-180.

Tanasichuk, R.W. 1998. Interannual variations in the population biology and productivity of *Thysanoessa spinifera* in Barkley Sound, Canada, with special reference to the 1992 and 1993 warm ocean years. Mar. Ecol. Prog. Ser. 173:181-195.

Surveys have been conducted in the Strait of Georgia in 1999 and 2000 to estimate the abundance of euphausiids in the Strait of Georgia using hydroacoustic technology. However the data and information on these surveys remains unpublished at this time although significant increases in biomass were evident in 2000 where essentially an astonishing increase or doubling of standing stock was noted (Neville, C 2001 Pers. Comm.).

4.4.4.3. Prospects for the fishery

No increase in quota will be considered until such time as a sound scientific basis is provided and accepted by the DFO Regional Management Executive Committee (RMEC). The euphausiid fishery is managed conservatively through an adaptive management regime that will continue in its present form at the discretion of the Regional Management Executive Committee. A precautionary approach to management, which ensures the Department is meeting its conservation and sustainability goals, will continue for the foreseeable future. The Department will continue to promote a biologically based management regime through a collaborative process with the commercial industry and other stakeholders.

4.4.5. Current Management Issues

ISSUE:	ACTION:
Fishers are interested in expanding the fishery and increasing the quotas and areas the fishery may occur. They are unclear about the DFO requirements before this would be considered.	DFO Senior management does not allow for increase in the quotas or areas fished for this forage species as a matter of policy at this time.
The Department has a minimal amount of published biological data with which to assess the fishery and from which to develop/alter management plans.	Continue to encourage and support stock assessment staff to finalise and publish research surveys.
Limited and isolated inaccurate reporting of commercial harvest information is attributed to lack of fisher knowledge of Area boundaries.	Maps of quota management areas are included in the MP since 2000.
The Validation & Harvest logbooks and harvest charts show a concentration of effort into some fishing locations. This has created some concern for the effects of localized overfishing.	Continue to monitor levels of fishing effort and survey data to determine if effort concentrations are significant and negatively impacting stocks.
Licence holders need ample time to buy licences, obtain logbooks and travel to the fishing grounds prior to the start of the fishing season.	Continue to make licences available two to three weeks prior to the opening time to allow for preparation time for buyers, fishers, and the service bureau.

4.4.6. Specific Management Objectives

4.4.6.1. Conservation/Sustainability

Stock Assessment and Fisheries Management aim to:

- Collect fishery data in a way that will test current assumptions of population abundance and productivity.
- Harvest static areas to enable the collection of a time series of fishery-dependent information, which can be examined to determine harvest impacts within these areas.
- Develop research and fishing protocols that will enable the Department and industry to acquire the needed information for the wild fishery and potential aquaculture initiatives.

- Collaborate with the commercial industry and First Nations to conduct abundance surveys and test harvest rates.

4.4.6.2. International Considerations and Obligations

Information to Transport, Import and Land Shellfish in Canada

Pursuant to the *Coastal Fisheries Protection Act*, foreign fishing vessels can only enter Canadian waters and offload fish where a licence is issued under *the Coastal Fisheries Protection Regulations* or such activities are authorized by a treaty. In the case of U.S. vessels, there is a treaty in place for roe herring, salmon, tuna, halibut and sablefish. However, only vessels from flag states listed in section 5(1)(a) of the *Coastal Fisheries Protection Regulations* are eligible to be issued licences to land fish in Canada. As the U.S. is not on this list, U.S. vessels are not eligible to receive licences to land other species (including shellfish) in Canadian ports.

Masters of Canadian fishing vessels receiving shellfish, i.e. trans-shipping shellfish, from a U.S. fishing vessel, in waters other than Canadian fisheries waters, require four licences. Contact the Pacific Fishery Licensing Unit in Vancouver (Tel: (604) 666-0566, Fax: (604) 666-5855) for further information.

4.4.6.3. Domestic Considerations

Aboriginal fishery

Fisheries and Oceans Canada recognizes the importance of fish to the Aboriginal people of British Columbia. The Department will continue to provide First Nations with access to harvest fish for food, social and ceremonial purposes, in a manner consistent with the Sparrow decision (see the Internet at: http://www.pac.dfo-mpo.gc.ca/ops/fm/AFS/Default.htm for more information).

It is the policy of the Department to encourage increased Aboriginal communal participation in and integration with coastal commercial fisheries. Aboriginal involvement in the fishery is a shared goal between the Department and Aboriginal people. It is a means to stimulate Aboriginal economic development opportunities and develop fisheries expertise in Native communities, while serving as the basis for more co-operation between Aboriginal communities and the commercial fishery sectors. Aboriginal participation in the commercial euphausiid fishery is being accommodated through the AFS Licence Retirement/Allocation Transfer Program. The Fisheries and Oceans Canada Aboriginal Fisheries Strategy Licence Retirement Transfer Program (ATP) retires existing commercial licence eligibility's from fishers on a voluntary basis and re-issues these to eligible Aboriginal organizations as communal commercial licences (category "FZF" licences).

Recreational fishery

The Department does not see it is necessary or appropriate to promote a recreational fishery for euphausiids.

Commercial Fishery

The Department will continue to work collaboratively with the KTA and other stakeholders to improve the biological database and thus improve the assessment of the fishery resource.

In order to assist vessel masters and fishers in gaining knowledge and understanding of the *Pacific Fishery Management Area Regulations*, maps are provided in the management plan showing general euphausiid quota management areas.

Exploratory/experimental fishery

Industry has identified a ten tonne portion of the catch that can be set aside to support scientific and other marketing projects.

4.4.7. Management Measures

4.4.7.1. Fishing Seasons

The Mainland inlet fishery in Jervis Inlet, Toba Inlet, Homfray-Lewis-Pryce Channels, Bute Inlet and Knight Inlet occurs early in the New Year. In 2000 these areas opened 12:00 hours January 3. The Inlet areas may remain open until either the individual inlet quota is attained or until March 31 in each year. All inlet areas close in March 31 each licence year, but may re-open August 16 each year upon request to the Fishery Management Coordinator, pending quota availability. If reopened these areas will remain open until the inlet quota is caught, or until October 31 each year, whichever occurs first.

The Fall/Winter Fishery occurs in areas of the Strait of Georgia, (Subareas 15-1, 15-2, 15-3, 16-18, and that portion of 16-11 westerly of a line from Ahistrom Pt. light 175° true to a point on the shoreline on Nelson Island). Beginning in early November. In 2000 this area opened to euphausiid fishing 12:00 hours, November 1. This area can remain open until either the quota of 215 tonnes plus the balance of the inlet area quotas are attained, or until December 31 of each year.

All fishing periods open and close at 12:00 hours local time.

Opportunities for First Nations' and recreational harvesting continue year-round.

4.4.7.2. Control and Monitoring of Fishing Activities

Catch Validation Agreement

A collaborative agreement between the Department and the KTA is consistent with the Department's approach to co-management in the Region. This agreement provides for tracking of fishing activity through a hail in notification requirement, catch validation at designated landing ports, in-season collection and compilation of harvest log data, collection of biological samples as required and a year-end summary report of the fishery. The program is industry funded.

Fishing Notification and Dockside Validation

In 1997, when the hail in and dockside validation program was implemented, a service bureau was contracted by the KTA to provide the services. Fishers are required to report to the service bureau prior to fishing, following fishing, and prior to landing euphausiids. All catch must be weighed and validated at the first point of landing by a Fisheries and Oceans Canada certified observer.

4.4.7.3. Licensing

Commercial Fishery:

Euphausiids are harvested commercially under the authority of a commercial licence (ZF) or a communal commercial licence (FZF). All licences are held by an individual party who must designate a harvest vessel each year. The designated vessel must be eligible for a commercial vessel based licence of any of the following categories: A, C, F, G, K, L, N, R, S, T, and W.

Commercial (ZF) licences are "transferable" in that a licence holder may nominate a new party as the holder of the licence eligibility. Communal commercial (FZF) licences are allocated annually to First Nations groups, who may designate the licence to a vessel which meets the same criteria as the general commercial fishery licences.

Commercial euphausiid licence fees for the 2000 season were $100 per licence.

Vessel length restrictions apply for all vessels used to harvest euphausiids under the authority of a "ZF" licence. "ZF" licences may be designated to a vessel of the same length only. Designated vessels must have a vessel survey on record with the Pacific Fishery Licence Unit, dated subsequent to May 1989. Vessel redesignation will only be permitted if the licensed vessel is out of service.

Aboriginal Fishery:

First Nations access to fish for food, social and ceremonial purposes are managed through a Communal Licence for all shellfish species. Catch monitoring and reporting requirements are outlined in the fisheries agreement and/or Communal Licence. Communal Licences can be amended in-season for resource conservation purposes.

Recreational Fishery:

A B.C. Tidal Waters Sport Fishing Licence is required for the recreational harvest of all species of fish. The daily limit for the recreational harvest of euphausiid under a general regulation is 20, with a possession limit of 40.

Processing

P-licences have not been issued to vessels in this fishery. Vessels are currently allowed to freeze their own catches however there are parties interested in bringing additional freezer vessels onto the fishing grounds. Vessels other than the catcher vessels would be require to have "P" category licences to accept the catch of other vessels for freezing.

"P" licences are issued under the Pacific Fishery (General) Regulations, and must comply with the Fish Inspection Regulations. As a result, effective June 1998, any processing beyond that permitted in Section 14 (FIR) must be done in a registered fish processing facility and in full compliance with a Quality Management Program (QMP). If product processed at sea is to be eligible for export (leaving B.C.), the vessel must be a registered fish processing facility, i.e. registered with the Canadian Food Inspection Agency (CFIA) and have an approved QMP. If the processed product is intended for sale within B.C., the vessel must meet B.C. Ministry of Fisheries and B.C. Health requirements, prior to the issuance of a "P" licence.

4.4.7.4. Key Legislation

- The *Fisheries Act* and the regulations made thereunder.
- Areas and Subareas, as described in the Pacific Fishery Management Area Regulations, are referenced in describing quota management areas. Other legislation referenced for this fishery includes the Fishery (General) Regulations (i.e. Conditions of License) and the Pacific Fishery Regulations, 1993 (i.e. open times and size limits).

- The British Columbia Sport Fishing Regulations (1996) and the Aboriginal Communal Fishing Licenses Regulations.

4.4.7.5. Conservation Harvesting Techniques and Selective Fishing Requirements

The commercial harvest of euphausiids meets the Pacific Region's requirements for avoiding "known non-target species and stocks or, if encountered, to release them alive and unharmed." The bycatch in this fishery is limited.

4.4.8. Enforcement Measures

4.4.8.1. Overview

This fishery is considered a low priority. Conservation & Protection staff will pursue opportunities to monitor and enforce the issues/problems associated with this fishery in conjunction with the monitoring and enforcement activities associated with the identified priority fisheries in the Pacific Region.

The industry funded "hail in and dockside" validation program initiated in 1997 was again effective in addressing quota overages and reporting concerns in the fishery in 2000 The program provided for timely and accurate tracking of catches and fishing activities. However discrepancies in the sales slip, harvest log, and validated landing data continue but are more clearly understood. Combining the Harvest log and validation log into a single report improved past discrepancies between logbook records and validation logs. Directed efforts will be required to ensure that fishers submit of their logbook/validation records in a timely manner. Sales slip information deficiencies may be more challenging to rectify due to the marketing process where product may be sold long after in has been harvested. Future enforcement efforts may be best directed at "forensic audits" to confirm the accuracy of the dockside validation program and to clarify discrepancies in sales slip and validation data.

4.4.8.2. Main Program Activities

In order to address the priority issues of catch validation, licensing and the harvest of prohibited species identified by Fisheries Management staff, Fishery Officers will pursue opportunities to monitor and inspect fishing vessels at sea and periodically conduct landing verifications.

Since the introduction the industry funded hail in and dockside validation program enforcement effort has focussed on ensuring compliance with registration and fisher's licence requirements, logbook completion, and closed time/area patrols.

Inspections of vessels participating in this fishery will focus on the priority issues with respect to hails, landing records, and harvest log requirements. Closed time/area patrols may be conducted by Canadian Coast Guard (CCG) patrol vessels, program vessels, or by air in conjunction with priority fishery patrols. Investigations may also occur on an opportunistic basis with notification from Fisheries Management that a violation has occurred.

4.4.8.3. Fishery Patrol Vessels

All at-sea patrols will be conducted on a priority basis, using CCG patrol vessels staffed with Marine Enforcement Officers and/or Fishery Officers, and C&P program vessels (primarily 733 Rigid Hull Inflatable Boats) with Fishery Officers aboard.

4.4.8.4. Air Surveillance

Patrol coverage using aircraft is not anticipated at this time. There may be limited opportunity to utilise the Regional-Air surveillance plane to patrol closed areas/time and locations of fishing vessels, if priorities allow and the contract is renewed.

4.4.8.5. Enforcement Issues and Strategies

Issues	**Sections**	**Strategy**
Licensing Verification • Vessel licensed. • No Fishers Registration Card (FRC). • Fail to produce FRC.	Pacific Fishery Regulations (PFR) (S)22 PFR (S)25 Fisheries General Regulations (F(G)R) (S)11	At-sea and dockside inspections will occur when opportunities exist. These inspections may include checks of all licensing documents on board the vessel to ensure compliance with the Regulations.
Fish during close time/area.	PFR (S)63	Patrols utilizing CCG patrol vessels will be pursued when opportunities exist. Possibilities may exist to use the Regional Enforcement Charter Aircraft in co-ordination with other scheduled patrols of priority fisheries.
Fail to maintain Harvest logbook and Chart Data.	F(G)R (S)22(7)	At-sea dockside inspections will occur when opportunities exist. Investigation will occur on an opportunistic basis after C&P has been notified that a violation has occurred. The investigation will be pursued as priorities permit.
Processor "P" licensing requirements will be in effect for vessels freezing catches, except for catcher vessels which may freeze their own catches.	PFR (S)23	At-sea dockside inspections will occur when opportunities exist. Investigation will occur on an opportunistic basis after C&P has been notified that a violation has occurred. The investigation will be pursued as priorities permit.
Fail to provide proper landing and hail lack of notification for change of area, cancellation of trip, or incorrect reporting of area fished.	F(G)R (S)22(7)	At-sea dockside inspections will occur when opportunities exist. Investigation will occur on an opportunistic basis after C & P has been notified that a violation has occurred. The investigation will be pursued as priorities permit. Aircraft or vessels may be used on an opportunistic basis to track vessels in the

Issues	Sections	Strategy
		fishery.
Pair Trawling	F(G)R (S)22(7)	At seas fishery observations of vessels engaged in pair trawling activities. Investigation will occur on an opportunistic basis after C&P has been notified that a violation has occurred. The investigation will be pursued as priorities permit.

4.4.9. Financial Responsibilities

4.4.9.1. Industry and/or other Harvesters

The Department holds a collaborative agreement with the KTA for the fishery activity notification and catch validation program. The KTA funds the program through a royalty applied against the poundage landed in the fishery, that is paid to the association to cover the costs of the hail in line, quota tracking service, and the annual year end report. Validations are paid for by the fishers directly to the service bureau as they occur.

4.4.9.2. Fisheries and Oceans Canada

One Stock Assessment and two Resource Management personnel are directly involved in this fishery. Contributions to the Management Plan and the Fishery Updates are provided by the Fisheries Management Directorate, the Science Branch, the Shellfish Data Unit, the Conservation and Protection Directorate, the Pacific Fishery Licence Unit, the Aboriginal Fisheries Strategy, the Recreational Fisheries Division, the Oceans Directorate and numerous administrative personnel. Generally, all personnel are multi-tasked, i.e. Shellfish Fishery Managers work on all shellfish fisheries. Therefore, costs incurred by the Department to manage this fishery are difficult to assess.

4.4.10. Performance Review

4.4.10.1. Management Plan Evaluation Criteria

- Assess and review effectiveness of industry funded hail in and dockside validation programs annually.
- Maintain lines of communication and continue consultation with all clients, interested parties, and First Nation's groups.
- Continue to promote and encourage surveys, experimental studies, and development of value added products.
- Continue to provide maps of Euphausiid Quota Management Areas in the 2002/2003 Euphausiid Fishery Management Plan.
- Continue to explore alternate management options in the fishery i.e. Individual Vessel Quotas.

4.4.10.2. Annual (Post-Season) Review Results

See year 2000 Euphausiid Fishery Year-End Report, D and D Pacific Fisheries Ltd.

4.4.11. References Cited

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4.4.12. Acknowledgments

I would like to thank Mike Kattilakoski, Shellfish Technician, South Coast Area office, Nanaimo, B.C., for his assistance in updating Table 4.4.I, and obtaining annual sales slip value information for this report.

Table 4.4.1. History of management actions in the commercial euphausiid fishery.

YEAR	ACTION	SUMMARY
1970:	South Coast	Experimental fishery for euphausiids initiated South of Cape Caution. First commercial landings.
1976:	South Coast	Quotas established and set at 500 tonnes.
1983:	South Coast	Fishery Licensed under at category "ZF" licence. Logbooks were issued.
1986:	South Coast	Quota of 25 t assigned to Howe Sound area.
1989:	South Coast	Annual Quota increased to 785 tonnes and catches divided between Malaspina Strait area - 500 tonnes and Inlet areas quotas of 20 to 75 tonnes.
1990:	South Coast	Coastwide quota re-established at 500 tonnes due to concerns over local overfishing.
1990:	South Coast	530 tonnes landed in fishery. Highest record of landings in fishery.
1992:	South Coast	Loughborough Inlet area closed. Quota reassigned to Homfrey-Price-Lewis Channel area.
1995:	South Coast	Malaspina Strait fishing area expanded to include lower Jerks Inlet to Ahistrom Point Light to promote safer fishery operations and less exposure to prevailing weather conditions in winter months.
1997:	South Coast	Industry funded hail in and dockside program initiated to address quota tracking problems and data inconsistencies.
1997 to 1999:	South Coast	Industry funded hail in and dockside validation program continued.

Table 4.4.2. Euphausiid landings (tonnes) and effort for British Columbia, 1983 to 2000, as reported on fish slips, harvest logs and validated landings.

Year	Type and Number of Licences Issued	Number of Vessels with Landings[1]	Fishing Days[1]	Quota (t)	Landings[1] (t)	Landings[2] (t)	Landings[3] (t)	Landed Value[1] ($\$10^{-3}$)	Whole Landed Value[1] ($\$*t^{-1}$)	Effort[2] (hours)	CPUE[2] (kg hr^{-1})
1983	7 Z-F	<3	50	500	*	*		*	*	*	*
1984	8 Z-F	4	67	500	94	103		38	404	563	182
1985	5 Z-F	<3	65	500	*	*		*	*	*	*
1986	11 Z-F	<3	67	525	*	*		*	*	*	*
1987	18 Z-F	3	36	525	130	156		102	785	370	421
1988	24 Z-F	4	11	525	247	249		191	773	980	254
1989	45 Z-F	15	225	785	360	298		215	597	1150	259
1990	56 Z-F	17	255	500	530	499		415	783	1321	378
1991	45 Z-F	14	152	500	450	445		391	869	1211	367
1992	25 Z-F	10	89	500	381	343		318	835	470	729
1993	18 Z-F	<3	29	500	*	*		*	*	*	*
1994	18 Z-F	6	122	500	333	375		259	778	614	610
1995	18 Z-F	7	164	500	562	506		357	635	944	536
1996	18 Z-F	10	144	500	507	490		472	931	642	764
1997	18 Z-F	7 (12)[5]	224	500	239	322	382	335	876	894	361
1998	17 Z-F	6 (10)[6]	116	500	276	444	491	493	1004	503	883
1999[4]	18 Z-F	7 (13)[7]	116	500	322	411	460	447	972	777	526
2000[4]	18 Z-F	6 (11)[8]	83	500	370	474	504	482	957	435	1159

[1] Fish slip data. From 1997 onward value is extrapolated from validated landings.

[2] Harvest log data.

[3] Validated landings. Source: D&D Pacific Fisheries Ltd.

[4] 1999 and 2000 data are considered preliminary for fish slips.

[5] 1997 fish slips show 7 vessels with landings. Validated landings show 12.

[6] 1998 fish slips show 6 vessels with landings. Validated landings show 10.

[7] 1999 fish slips show 7 vessels with landings. Validated landings show 13.

[8] 2000 fish slips show 6 vessels with landings. Validated landings show 11.

* Data not provided for reasons of confidentiality where less than 3 boats report landings.

4.5. Goose Barnacle Experimental Fishery – D. Clark

4.5.1. Introduction

The commercial goose barnacle (*Pollicipes polymerus*) fishery was closed May 31, 1999 as a result of concern over the impact of harvesting in sea mussel beds and the impact of harvesting on goose barnacle stocks. A lack of data about the biomass of the resource and inconsistencies in fishery data resulted in a lack of confidence that the resource was being managed in a precautionary manner. A complete record of management actions that have been taken over the years is contained in Appendix 4.5.1.

This fishery update will summarize the landings that entered the market from experimental harvests conducted in 2000 as well as historic landings. It will not provide the results of these studies, as analysis had not been concluded prior to completion of this report. Pre-harvest and post-harvest observations will require the 2001 field season to provide any specific information. The analysis and review of this information will be conducted by the Stock Assessment Division.

4.5.2. Objectives

The objectives of the scientific studies:

- Apply a stock assessment and ecological framework to collect the necessary information to ensure the long-term biological and economic sustainability of the commercial goose barnacle fishery.
- Conduct broad-brush surveys in consultation with experienced First Nations and commercial harvesters to document the biomass of goose barnacles on the west coast of Vancouver Island (Areas 23, 24, 25, 26) from Brooks Peninsula to Cape Beale.
- Define the impact of harvesting in a qualitative and quantitative manner.
- Define baseline species presence and ecosystem assessments and re-colonization and recruitment to vacant mussel bed patches.
- Provide a report with recommendations for future direction of the goose barnacle fishery to PSARC.

The landings included in this Fishery Update were made in support of the third objective.

4.5.3. Goose Barnacle Working Group

A working group open to experienced harvesters, government agencies, First Nations and harvesters organizations has been participating in defining the scope and location of studies and the experimental harvests. Five meetings were held in 2000 with approximately 25 harvesters from coastal communities who identify themselves as experienced harvesters. Scientific licences were issued to the two harvesters' organizations to enable commercial harvest impacts to be documented.

4.5.4. Defining the Impact of Harvesting

In 2000, sites were selected with the help of experienced commercial harvesters and baseline information was collected. Ecological studies were initiated by collection of information on the species mix at specific sites. Surveys for sea mussel and goose barnacle biomasses were conducted at sites that were identified as productive. Commercial harvesters were then provided the opportunity to harvest on those sites that were not in ecological reserves or marine parks. A harvest monitor familiar with the sites was required to be present during the harvests.

4.5.5. Catch and Effort

Participation in experimental harvests was determined by the harvesters' organizations. The extent of harvests was limited to the areas that had been documented by biomass estimates. An experimental, scientific licence was issued for a specific time period and included conditions of licence that detailed the names of harvesters involved, and information on the processing plant to be used for export certificates. Harvests continued at each location until the harvesters considered that there were few marketable goose barnacles remaining. Repeat harvests at the same site occurred at some locations three months after the first harvest, and the harvesters indicated that marketable product had grown back at those sites.

4.5.5.1. Landings

Fish slip summaries for 2000 show landings of 1 ton by the two harvesters associations (Table 4.5.1 and Figure 4.5.1), the Canadian Goose Neck Barnacle Harvesters Co-operative (CGNBH Co-op) and the West Coast Gooseneck Barnacle Association (WCGBA). Landings for 2000 were validated at a shore location on the day of harvest and again at the processing plant prior to export, so there is no discrepancy between fish slips and export certificates as in previous years (Figure 4.5.2).

4.5.5.2. Effort

Harvesting in 2000 was restricted to a few tides each licence, and specific arrangements were required so that the product could be processed and shipped to Spain. All of the harvests were evening and night harvests. There were 5 shipments made from 23 days of harvest. There were 3 to 6 harvesters participating at any one time for a total of 64 fishing days. No harvesting was conducted for the December 26 licence as a result of difficulties getting guarantees for cargo space during the Christmas season. Weather would also have been a factor during these harvests.

Table 4.5.1. Goose barnacle scientific licences authorizing harvest for commercial sale and landings in 2000.

Scientific Licence Organization	Date Processed	Days of Harvest	Number of Harvesters	Fishing Days	Landed Dockside (kg)	Discards (kg)	Processed Weight (kg)- Fish Slips
CGNBH Co-op	18-Sep-00	5	5	20	277.6	22.6	215.7
WCGBA	18-Sep-00	5	6	15	428.0	3.2	340.7
WCGBA	05-Oct-00	3	3	9	329.6		203.0
WCGBA	17-Oct-00	5	3	13	312.4		252.0
WCGBA	16-Dec-00	5	5	16	469.7	32	431.2
WCGBA	26-Dec-00	0	0	0			0.0
Totals		**23**	**22**	**64**			**1442.5**

Harvests were conducted in areas 23, 24, and 26 and in September, October and December. Recreational and First Nations harvesting for food, social and ceremonial purposes was not limited by the commercial fishery closure. No measurement of the amount of harvest or the effort in harvesting has been made. Occasional reports of large harvests after the closure, suspected for commercial purposes, may have been for special ceremonies or gatherings such as Mother's day.

4.5.6. Data Collection

A harvest monitor was required for the experimental harvests. Funding for the monitor was provided by DFO through the Pacific Fisheries Adjustment and Restructuring (PFAR) Program.

Data collected during the harvest will be summarized by Stock Assessment once the second year of field data is available. Discards of too small or too large goose barnacles during harvest were observed and documented, as well as dislodged or damaged sea mussels. Product weight was validated at the beach and again at the processing plant prior to export. Weight loss due to water loss during transport and holding of harvested goose barnacles accounts for a significant reduction in the weight of processed product (as high as 38% for October 5 shipment). Discards at the processing plant were minimal as a result of prior sorting on the rocks during harvest and before transport to the plant.

4.5.6.1. Stock Assessment Activities

The stock assessment studies conducted in 2000 will not be reported here, and are in the process of being analysed by Stock Assessment Division. A final report will be compiled and presented to PSARC once pre-harvest and post-harvest information is gathered.

4.5.7. Stakeholder Participation

A number of experienced fishermen have formed the Canadian Goose Neck Barnacle Harvester's Co-operative and a second harvesters organization, the West Coast Goose Barnacle Association, was formed, primarily by First Nations harvesters. The Department has encouraged these groups to form a goose barnacle sectoral committee to deal with coastwide concerns within this fishery. Such a group could provide important information on stock strength, conservation concerns, management changes, and economic development. The implementation of licence limitation in this fishery is a priority issue for the core group of experienced harvesters involved in the Co-op. The members of the Co-op are interested in stabilising prices to harvesters and pursuing the Japanese and Asian markets. Funding from Fisheries Renewal BC was provided in 1999 to assist in the formation of the harvesters' co-operative and to investigate markets and harvester participation. The closure of the fishery has suspended some of the initiatives and limited the scope of what the co-operative can achieve. Since the closure of the fishery in May of 1999, a second harvesters' association has been formed, the West Coast Goose Barnacle Association. There are also experienced harvesters who are not members of either association.

4.5.8. Priority Issues for Phase 1 Studies

The following issues remain unresolved:

1. **Health and Safety:** The risks of working in wave-swept rocky intertidal areas will require minimum standards for vessels, safety equipment and safety procedures.
2. **Harvesting in Marine Parks:** Ecological reserves, the Bamfield research reserve and Pacific Rim National Park Reserve were identified in previous management plans. Provincial Marine Parks were established in 1995 to incorporate Clayoquot Sound and much of the coastline in Management area 24. Commercial activity within marine parks is not supported. Much of the area of goose barnacle habitat is

of significant interest in treaty negotiations with various First Nations organizations. Closed areas will need to be defined and evaluated as goose barnacle production reserves.

3. **Study Protocol:** Specific physical and biological measurements, timelines and logistical support are being determined as the study progresses. Long term studies for estimates of habitat regeneration are yet to be determined. Application for funding for 2001 has been made to the Pacific Fisheries Adjustment and Restructuring Program and would provide for field work for 2001.
4. **Terms of Reference for Working Group:** A set of terms of reference (TOR), to provide logistics to accomplish the phase 1 studies, has been defined to deal with immediate needs. A more detailed TOR has been drafted to provide options for the future development of an industry support organization. The larger TOR needs DFO input and acceptance for the long term direction of this working group.
5. **Future Extent of the Commercial Harvest and Participation in the Commercial Fishery:** The Working Group will have a significant role to play in defining who has the opportunity to participate in any future commercial fishery. Licence issue, landings records and harvest log reporting was so inconsistent in the last few years of the fishery that it does not reflect the level of interest, especially in small coastal communities with few economic alternatives.

4.5.9. Criteria to Decide on Re-opening and Sustainable Harvesting

The scientific studies will provide specific information on which to base decisions on the potential for a sustainable goose barnacle fishery, but in themselves will not guarantee a fishery. With specific information on the impacts of harvesting techniques it will be necessary to make decisions on the future of this fishery. To define a biologically sustainable, ecologically sensitive and economically viable fishery, specific criteria will need to be established under which this fishery will re-open. The current studies will provide:

1. A biologically based assessment of the goose barnacle stocks
2. A description of the impacts of harvesting on goose barnacles
3. A description of the ecological impact of harvesting goose barnacles

This information, expected to be available for the summer of 2002, will be used to decide if a goose barnacle fishery is biologically sustainable and will help to establish biological reference points, total allowable catch by area or some other method of controlling the total harvest and its impacts.

Further criteria to be defined:

1. A code of conduct for harvesters that takes into consideration any negative aspects of 2 and 3 above.
2. Closed areas (ecological reserves, federal and provincial parks, refuge areas).
3. A health and safety plan for conducting the fishery.
4. A licensing plan including allocation, eligibility criteria and effort limitation
5. An enforcement plan.
6. A plan to accommodate First Nations access for food, social and ceremonial harvests.

4.5.10. References Useful in the Review of the Goose Barnacle Fishery

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Table 4.5.2. Goose barnacle landings (tonnes) and effort for British Columbia 1985 to 2000, as reported on fish slips and harvest logs.

Year	Number of Z6 Licences Issued	Licences with Landings[1] (slips)	Licences with Landings[2] (Logs)	Fishing Days[1]	Landings (t) (Slips)	Landings (t) (Logs)	Landed Value[1] ($1000)	Whole Landed Value[1] ($ per kg)
1985	9	–		145	1		1	1.00
1986	25	–	2	77	1.6	1	4	2.00
1987	221	–	39	798	31.3	10.9	211	6.56
1988	467	–	61	1596	48.7	31.2	479	9.78
1989	130	–	38	713	30.3	23.6	343	11.43
1990	137	49	40	2278	37.4	21.8	413	11.14
1991	131	30	32	3070	40.7	25.4	418	10.31
1992	125	39	24	1878	37.6	18.9	448	11.80
1993	105	32	20	2049	30.1	15.6	320	10.67
1994	114	37	20	1482	27.9	18.4	273	9.79
1995	65	7	15	288	7.1	7.4	73	10.30
1996	56	22	14	568	14.3	10.6	112	9.01
1997	49	19	4	427	10.1	4.6	96	9.50
1998	37	12	5	230	4.3	3.0	40	9.46
1999[3]	20	11	5	104	3.2	1.5	32	10.14
2000[4]	6 Scientific	5	0	57	1.0	n/a	12.9	12.68

[1] from fish slip data only, prior to 1990 no information on individual landings

[2] from harvest logs

[3] fishery closed May 31, 1999, partial year only

[4] Scientific, Experimental licences issued to document impact of harvesting

Table 4.5.3. Annual goose barnacle landings (tonnes) by Management Area, 1985 to 2000, as reported on fish slips.

	MANAGEMENT AREAS															
	North Coast						South Coast									Annual Landings
Year	1	2	5	7	8	10	11	12	20	21	23	24	25	26	27	
1985																1.0
1986								1.2			0.2	0.2				1.6
1987			0.0					0.2	0.1	0.1	11.0	18.0	0.5	1.3	0.1	31.3
1988		0.2		0.1	0.1	0.7	0.4	0.5	0.2		6.6	19.0	3.0	17.0	0.9	48.7
1989		0.5		0.7	1.2		0.1	0.1			3.9	11.0	0.1	12.8		30.3
1990					0.4						8.0	13.0		15.0	#	37.4
1991								0.3			9.0	16.0	#	15.0		40.7
1992					0.2			#			2.6	5.7		28.5	0.2	37.6
1993		#					#				5.1	9.3		15.5	#	30.1
1994	8.8			0.2							7.5	4.8	#	5.1	#	27.9
1995											1.0	0.8		5.3		7.1
1996											4.7	6.9	#	2.4		14.3
1997								#			4.2	5.1	#	#		10.0
1998											1.2	3.1				4.3
1999								#			0.7	1.1		#		3.2
2000*											0.5	0.3		0.2		1.0
Totals:	8.8	0.8	0.0	1.0	1.9	0.7	0.6	3.8	0.2	0.1	66.2	114.3	5.6	119.1	2.4	

* Beginning of experimental fishery.

Prior to 1990 landings were not separated by individuals.

# Numbers are obscured due to confidentiality requirements

Appendix 4.5.1. History of management actions and scientific review of the British Columbia commercial goose barnacle fishery.

Year	Management Action
1978-79	First commercial landings of goose barnacles under scientific license (20 tons by one company, 2500 lbs by another harvested from Tofino area). A number of shipments rejected by Spanish buyers because of decomposition. Transport and holding conditions critical but some success in holding up to 10 days.
1979	Management plan drafted to limit licenses and assign areas of harvest, but no legal authority to do this. These ideas were never incorporated into license conditions.
1979 to 1983	Small shipment in 1980 (30 kg) but otherwise no interest. Trade embargo as a result of fishing conflicts on the east coast.
1983	Scheduled under Z license category, fishing without a vessel to improve catch and effort statistics requiring logs and sales slips. It was believed that the fishery would be self-regulating due to the limited number of low tides and the limited accessibility of shore that can be worked.
1983	Proposal to dive for goose barnacles not supported by field trials and method was abandoned.
1984	18 Z licenses issued. Two unsuccessful attempts to initiate a fishery under scientific license. Small amount harvested from Tofino. All died in cold storage.
1985	Closed for assessment. Two proposals supported by feasibility studies. Barkley Sound studied (Bamfield Marine Station research reserve, Baeria Rocks, Pacific Rim National Park reserve and Cleland Island (Clayoquot Sound) ecological reserve identified as off limits. Quatsino sound live product for export and substandard product frozen for local market but low market value.
1986 to 1999	Unlimited entry, unlimited landings under Z license. It was considered that as a result of market demand for live product with specific product characteristics of size and colour, that the fishery would be self limiting. Estimates of 25% of the populations suitable for commercial harvest and removal of less than 10% (0.2% to 8%) of total population would be sustainable.
1989	Z6 license required. Unlimited entry, unlimited total allowable catch.
1990	Updated Z6 license conditions to improve logbook and sales slip reporting. A chart showing location of landings was a condition of license.
1997	PSARC review identified unlimited license with unlimited total allowable catch is not manageable. Goose barnacles identified along with four other invertebrate fisheries as priority for review following the phased approach.
1999	PSARC review of Phase 0 and framework for Phase 1 for sea mussels and Phase 0 for goose barnacles resulted in concerns over sea mussel habitat. The Subcommittee recommended: Given there are not sufficient data to recommend biologically based management for goose barnacles, more precautionary measures, including new management controls and assessment programs, be considered. That continuation of the goose barnacle fishery must follow the phased approach described in the Pacific Region Policy for New and Developing Fisheries
1999	RMEC directed Managers to close the fishery and an ecological assessment to be done on sea mussel habitat.
May 31, 1999	Fishery closed by revoking variation order. Notice to industry and letter to goose barnacle license holders sent out.
June 15, 1999	No further export certificates authorized by CFIA.
Nov 1999	Framework for Goose Barnacle Fishery presented at Invertebrate PSARC.
Dec 1999	Framework for Ecological Assessment presented at Habitat PSARC.
March 99 to April 00	Goose barnacle working group (including two harvesters associations) meeting to define logistics for scientific studies.
Sept to Dec 00	Scientific studies for species distribution, biomass estimates and impact of harvesting. Experimental harvests conducted at sites identified as having commercially harvestable goose barnacles.
May to Sept 01	Bed surveys, biomass estimates at index sites, biodiversity sampling.
Dec 2001	Experimental harvests at index sites and surveyed beds.

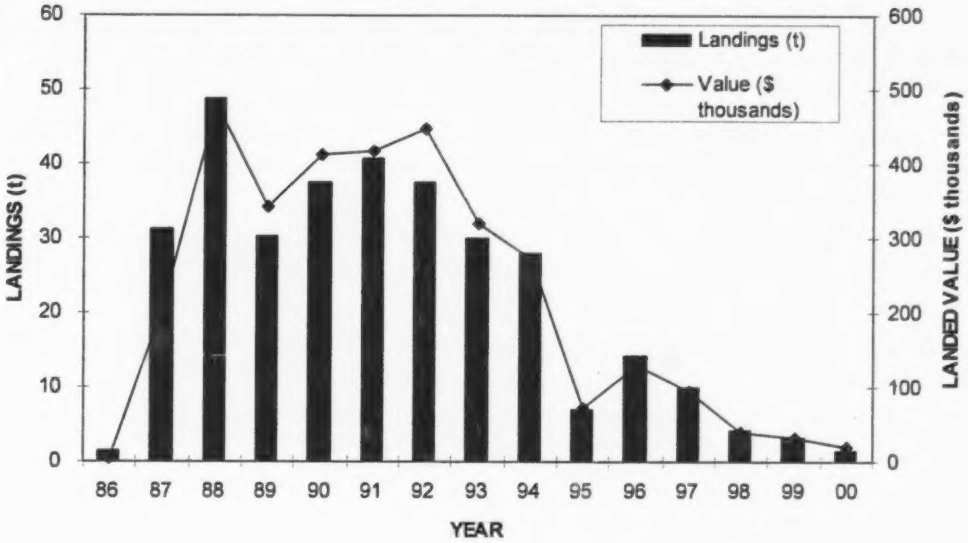

Figure 4.5.1. Goose barnacle landings (tonnes) and value (thousands of dollars), 1986 of 2000.

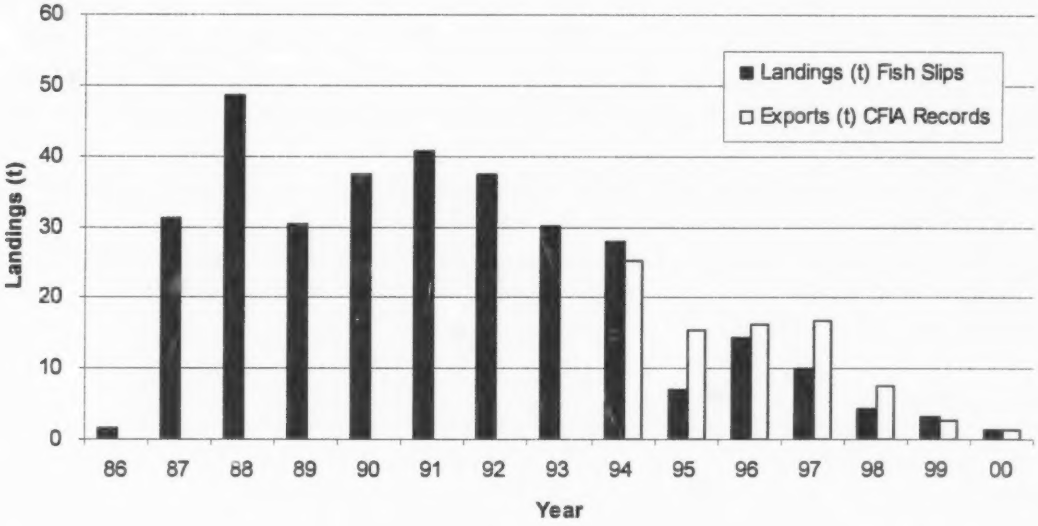

Figure 4.5.2. Goose barnacle landings, as reported on Fish Slips vs. export records.

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